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THE
BRITISH CYCLOPÆDIA
OF
NATURAL HISTORY.

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THE
BRITISH CYCLOPÆDIA

OF
NATURAL HISTORY:

COMBINING
A SCIENTIFIC CLASSIFICATION OF ANIMALS, PLANTS,
AND MINERALS;

WITH
A POPULAR VIEW OF THEIR HABITS, ECONOMY, AND STRUCTURE.

THE VARIOUS ARTICLES ARE WRITTEN EXPRESSLY FOR THIS WORK
BY AUTHORS EMINENT IN THEIR PARTICULAR DEPARTMENT.

THE WHOLE ARRANGED AND EDITED
BY CHARLES F. PARTINGTON,
PROFESSOR OF MECHANICAL PHILOSOPHY, AUTHOR OF VARIOUS WORKS ON NATURAL AND EXPERIMENTAL
PHILOSOPHY, &c. &c.

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THE HISTORY OF THE

THE
BRITISH CYCLOPÆDIA.

NATURAL HISTORY.

CETONIIDÆ (MacLeay). A family of coleopterous insects, belonging to the section *Pentamera*, and to the sub-section *Lamellicornes*, forming a portion of the great Linnæan genus *Scarabæus*, and corresponding with the section *Melitophila* of the Règne Animal. The body is depressed, generally oval, and gaily coloured; the head and thorax seldom cornuted; the thorax ovate-quadrate, or suborbi-



The Rose-chaffer in its different shapes.

cular; a corneous plate (forming portion of the sides of the meso-thorax, greatly developed,) occupies the space between the posterior and lateral margins of the thorax, and the external base of the elytra. The elytra are generally shorter than the body, the extremity of which is consequently exposed; the sternum is often prolonged into a point, thus resembling the *Buprestidæ*; the scutellum is generally distinct, and the tarsi are provided with equal sized simple claws; the antennæ are ten jointed, the club being composed of three joints. The structure of the mouth, which affords so complete an idea of the nature of the food of insects, is here remarkable. The upper lip and jaws, instead of being horny, as in the majority of beetles, are reduced to thin membranous plates, incapable of gnawing; the maxillæ are also terminated by a very hairy lobe, in the shape of a pencil, without horny teeth, and are only furnished with a single palpus. Now, on comparing this description with the figure of the under jaw of a predacious beetle, given in our article *CARABIDÆ*, the difference will be perceived to be very striking. In

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the latter, the structure indicates strong biting and lacerating powers; but in the *Cetoniæ*, the formation will serve only for lapping up vegetable juices, and we accordingly find that some of the species prefer the sap which flows from the wounds of trees, whilst others sip, with evident delight, the nectar of flowers.

These insects are distinguished from the family of cock-chaffers (*Melolonthidæ*), by the maxillæ not being terminated by several robust teeth as in the latter, by the upper lip being concealed by the clypeus, and by the antennæ, which are terminated only by a three-jointed fan.

The green rose-chaffer (*Cetonia aurata*) is one of the commonest, as well as one of the most beautiful, of our British beetles. It is found, very abundantly, during the summer months, especially in gardens, and frequenting the flowers of the rose, elder, peony, &c. We have also noticed that it is extremely partial to the privet, having observed a hedge of that tree, in the neighbourhood of Fulham, completely swarming with them. They fly well, with a considerable humming noise, during the hottest part of the day. This species is of a fine golden green colour, very shining above, and of a bright copper colour beneath; the wing covers are ornamented, near the tips, with numerous transverse narrow white markings. According to Latreille, these insects do not attack the essential parts of flowers, contenting themselves with merely sucking the honey from the bottom of the corolla. However, this may be, it appears that another species of the genus, (the *Cetonia hirta*), is very injurious to the flowers of the apricot in Malta—an account of its ravages having been published by M. St. John, in the Magazine of Natural History, No. XXIII. Of this insect, which the Maltese call Bouzuff, and the English inhabitants the Botany Bay, this author observes, "After he has filled himself, he retires under ground till the March apricot blossoms, when he emerges, and I am, for two months, obliged to have people employed solely to pick him off the blossoms, of which he readily *eats the nectary*, and having eaten one he goes to the next; he is very active, and flies like a bee. When the roses are in blossom, these beasts are so fond of them, that you may take twenty out of one flower, and in ten minutes as many more—a dark-coloured flower they never touch." Upon the commencement of this passage we would, however, observe, that it would therefrom be naturally inferred, that the writer supposed either that the animal maintained the same form on emerging in March, as it possessed on retiring under ground, or, at least, that the grub of the cetonia

had filled itself (it is not stated with what) in an exposed manner above ground, then retired into the earth, from whence it emerged in the perfect state in March. Neither of these ideas would, however, be correct, because the perfect cetonia only appears above ground for a short time in spring and summer, retiring thither again for the purpose alone of depositing her eggs, which is the last act of her existence. Moreover, the grubs of the cetonia do not feed above ground, but in rotten timber and wood; and, indeed, it is remarkable that the larva and pupa of the common rose-chaffer are often found under ground in ants' nests, where, it would seem, they support themselves by feeding upon the bits of wood of which the nests are composed, and without being attacked by their hostile hosts. From this circumstance they are called, in some countries, the king of the ants. After remaining two or three years in the larva state, they may be considered as full grown, when the larva makes a cocoon of bits of sticks, gluten, &c., in which it becomes an inactive pupa, and from which, in the following summer, it emerges.

Some difference of opinion exists as to the food of the larva of these insects; some authors supposing that they feed upon the earth in which they live, whilst others state that they attack the roots of living plants; and by some it is affirmed, that in this state they scarcely do any mischief to plants, feeding upon putrescent wood.

This family, which corresponds with Latreille's section *Melitophili*, is divisible into three sections. First, the *Trichides*, having the sternum not produced into a point, the thoracic lateral scales not developed, and the lower jaws not concealed by the chin. Here belong the British genera *Trichius*, *Gnorimus*, and *Valgus*, and some others proposed by Mr. Kirby in the Zoological Journal, and by Messrs. Gory and Percheron in their very beautiful *Monographie des Cétoines*, now in course of publication. In this first section we possess but four British species, which have been until recently placed in the genus *Trichius*, but the diversity of their habits sufficiently warrants their separation. Thus the beautiful *Trichius fasciatus* is always found upon flowers, whilst the *Gnorimus variabilis* not only passes its larva state within the bodies of decayed oak trees, but is found, on arriving at the perfect state, on the trunks of such trees. The *Valgus hemipterus*, on the contrary, is commonly found on the ground, where it creeps but slowly. This, and some North American species, are distinguished by the horny spear-shaped ovipositor at the extremity of the body, which evidently is employed by them to bore a hole in the earth for the reception of their eggs.

The second section, *Goliathides*, is distinguished from the preceding by the large size of the mentum which conceals the lower jaws. Here belong various exotic genera, of whose habits nothing is known, including, however, some of the largest and most beautiful species of lamellicorn insects.

The third section, *Cetoniides*, have the sternum pointed, and the lateral thoracic plates developed. Here belongs the British genus *Cetonia* (containing two British species) and various other exotic genera.

CEYLONITE. A mineral which derives its name from Ceylon, to which island it was originally supposed to be exclusively confined. It is now, however, found in considerable quantities in the rocky beds of the Rhine, and in several volcanic

districts. This mineral is distinguished from SPINEL, which see, by its semi-metallic lustre, inferior hardness, greater specific gravity, and inferior transparency. When it occurs in grains, it is apt to be confounded with tourmaline; but its semi-metallic lustre, greater specific gravity, and its not becoming electric by heating, distinguish it from that mineral.

CHÆROPOTAMUS. A name given by Cuvier to a genus of fossil pachydermata found in the gypsum in the neighbourhood of Paris, where it accompanies the remains of the anoplotheria and palæotheria, but is of much rarer occurrence than either of these. But little of this animal has been found, excepting the teeth and some parts of the head. The incisors (if there were any) have not hitherto been discovered. The canine tooth in the lower jaw is pointed, and tolerably large, and an empty space occurs between it and the first molar-tooth, which is conical, pointed, and slightly compressed, but by no means trenchant; it has two thick roots, which separate as they enter the alveolus. The second molar is rather more compressed, having also two roots; and behind its points, which are blunt, are two other points much lower, and scarcely projecting, which form a second lobe. Two teeth follow, which are tuberculated, having four principal tubercles on the coronal, which is nearly rectangular; two smaller tubercles occur in the middle of the others, and there are some other inequalities about their bases. These teeth resemble very closely the third and fourth molar teeth of the babroussa, and, generally speaking, teeth of this description indicate an animal of the swine family; but no known animal of this kind has the first molar of this conical form, and the pecari alone has a canine tooth as small as the chæropotamus, and besides is a much smaller animal than this appears to have been.

From these and other fragments, Cuvier was led to the conclusion, that the plaster quarries contain the remains of an animal approximating more nearly to the genus *Porcus*, than either the anoplotherium, or the palæotherium, which however differed in many particulars from any species of swine now existing. He offers as a conjecture, that the dichobunes, whose feet so nearly resemble those of swine, approached very nearly to this new genus, and possibly formed the link between it and the anoplotheria, properly so called. But one species (the *Parisiensis*) has hitherto been noticed.

CHÆTODON—bristle-tooth. A genus of spinous finned fishes, belonging to Cuvier's sixth family of the division, or those with scales on the fins. They obtain their name from the very peculiar form of the teeth, which are long, slender, and bristle shaped, ranged in several rows, and bearing some resemblance to brushes. Their mouth is very small; their dorsal and anal fins are covered with scales, not easily distinguishable from those on the back. They are exceedingly numerous in the warm seas, and many of them are so gay in their colours, that they are sought after with some avidity by collectors, as cabinet fish. Their intestines are long and large, with numerous long but slender cæca. The air-bladder is very large. They are usually found near reefs and rocky shores; La Cépède has enumerated forty-two species. Their flesh is excellent food, and they are much sought after by the sailors. They are remarkable for their form, and the brilliancy and variety of their colours. The limits by which the different species are separated are ill

defined, so that much confusion prevails in their nomenclature. They all inhabit the seas of tropical countries, and were unknown or disregarded by the ancients. The skeletons of some species have been found, along with other ruins of the animal kingdom, in the strata at Mount Bolca. La Cépède particularly mentions the remains of the *C. vespertilio* and *terra*. The *C. marginatus* appears to prefer the mouths of rivers, is very common at the Antilles, and its flesh is good. The flesh of the *C. macrolepidotus*, a native of the East Indies, is said, in point of delicacy, to resemble the sole. But the most extraordinary species is the *C. rostratus*, a native of the fresh waters of India. Dr. Shaw, after informing us that its prey consists of the smaller kinds of insects, says, "When it observes one of these, either hovering over the water or seated on some aquatic plant, it shoots against it from its tuberculous snout a drop of water, with so sure an aim, as generally to lay it dead, or at least stupified, on the surface. In shooting at a sitting insect, it is commonly observed to approach within the distance of from six to four inches, before it explodes the water. When kept in a state of confinement in a large vessel of water, it is said to afford high entertainment by its dexterity in this exercise; since, if a fly or other insect be fastened to the edge of the vessel, the fish immediately perceives it, and continues to shoot at it with such admirable skill, as very rarely to miss the mark."

In whatever part of the world they are found, these fishes are equally remarkable for their singular forms, their brilliant colours, and their great activity. They are so remarkable in these respects, that they have sometimes been described as occupying a similar place in the tropical seas to that which the parrots occupy in the tropical forests; and though, as is the case with all fishes, their colours fade much more after death than those of birds; they perhaps excel the parrots in brilliancy while they are alive. All their colours have a metallic lustre, and though some of them are of one very intense colour, as for instance golden yellow, ultra-marine blue, or rich bronze, when the fish is at rest, yet, when it moves, they are all iridescent and sparkle with a gem-like lustre. They are also exceedingly numerous, both in species and individuals, and as they keep near the surface, and frequently spring into the air, they have a very brilliant effect. The variety of them is, indeed, so great, that they have hitherto set description at defiance; and a mere list of them would occupy too much space in a work of this kind. Cuvier divides them into several sub-genera, of which, and one or two of the leading species, we shall give very short notices.

I. CHÆTODONS properly called. These have the body more or less elliptic, the spinous and soft rays of the fins are continued in a curve which is not very uniform; the muzzle is differently produced in different species; and in some of them the gill-flap is armed with a small tooth. The spines of the dorsal are sometimes very much produced. Most of the species of this sub-genus inhabit the eastern tropical seas. The following are some of the principal genera:—

Chætodon striatus, this species is sometimes called the zebra, on account of its stripes. It has the head and gill-cover armed with the same scales as the back; two openings to each nostril, the vent much nearer the head than the tail, the caudal fin is rounded. Its general colours are:—the ground a beautiful yellow, with four or five transverse bands of brown on the sides, and the pectoral fins black. It is one of the

largest species, and also plentiful; and its flesh, which is white, firm, and well flavoured, is much sought after.

Chætodon unimaculatus. This species is sometimes called the black spot; its distinguishing characters are, the tail forked, a black band crossing the nape, including the eyes, and extending down to the gill-covers, and a single large spot on each side of the back. It is found principally in the North Pacific, toward the Japan and Philippean islands.

Chætodon capistratus. This species has the tail rounded, the black band on the head straighter, and the black spots on the back surrounded with white. It is found in the same seas with the former species.

Those which we have mentioned are but a very few of the species or varieties of this abundant and interesting sub-genus; but the differences, though conspicuous enough, are not very important, as they are almost wholly differences of colour only.

II. CHELMONS. This sub-genus has been separated by Cuvier from the chætodons properly so called, in consequence of the peculiar form of the muzzle, which is slender, very much elongated, and has some resemblance to a whistle. The known species are inhabitants close in shore, and are understood to subsist chiefly upon air insects.

Chætodon rostratus. This is a very beautiful species, the ground colour being golden and silvery in alternate bands, with an ocellated spot, black in the middle and surrounded with white, immediately in the rear of the dorsal fin; this is the species formerly alluded to as being dexterous in shooting flies. In consequence of the beauty of its colours, and the liveliness of its action, it is often kept in vases by the people of the east, in the same manner as gold fishes are kept in this country.

Another species with the muzzle still more elongated, and of a lemon yellow colour with some black spots, has been described as inhabiting the South Sea.

III. HENIOCHUS—Coachmen. This sub-genus get their common name from one long filament proceeding from the dorsal fin, and sometimes extending to twice the length of the body. The form of this filament is not unlike that of the cord of a coachman's whip. The following is one of the principal species:—

Chætodon macrolepidotus. This is a large species, being sometimes met with of the weight of twenty-five pounds. Its flesh is very much esteemed; and its colours are brilliant, being very splendid, silvery in the greater part of the body, and crossed by two brown bands on each side. Several other species of this sub-genus are mentioned by systematic writers, but the accounts of them are not a little confused.

IV. EPHIPPUS—Horsemen. The principal character of these is a deep notch between the spinous and soft parts of the dorsal fin. The spinous part is without scales. This division is found both on the American coast and the east, and the species are very numerous.

V. HOLOCANTHUS. The leading character of these is a large spine on the angle of the gill-flap, the edge of which is also toothed. Like the preceding sub-genus, they are found both in the Atlantic and Pacific. The species is very numerous, their colours are beautifully arranged, and they are much esteemed as food.

VI. POMACANTHUS. These have the body more elevated, and their dorsal fin rises higher than in most of the species. They have been met with only on the American shores.

VII. PLATAX. These have their teeth closely set, the first row being trenchant, and each consisting of three points. Their bodies are very much compressed

or flattened sideways (hence their name). Their fins are very much elevated and covered with scales, so like the rest of the body, that they seem a continuation of it. There are a few small spines on the anterior edge of the dorsal, and the ventral fins are very long. The height of the fish, seen sideways, exceeds the length. There are several species of them, all natives of the Indian seas; and they are called sea-bats, and other fanciful names by the sailors. Some of them are found in the Red Sea.

CHAFFER. The common English name whereby various species of beetles are called, evidently adopted from the German *Kafer*, which is, however, employed as synonymous with the whole of the coleopterous insects to which we have applied the name of beetle. In Germany, however, from the great richness of the language, a distinct name is applied to every species of coleoptera; but in England, owing to the poverty of our tongue, and the small degree of attention hitherto paid to the subject, but very few insects have obtained vernacular names; and amongst these we find the term chaffer almost exclusively applied to beetles belonging to the Linnæan genus *Scarabæus*. Thus the *Melolontha vulgaris* (*Scarabæus vulgaris* of Linnæus) is commonly called the cock-chaffer, whilst the *Cetonia aurata* (*Scarabæus auratus*, Linnæus) has received the name of the rose-chaffer, &c. Of these, the first-named insect is by far the most obnoxious, from its destructive powers, whilst in the larva state, to grass, &c., devouring the roots. As, however, the name chaffer is not exclusively applied to this insect, it will be more convenient to defer its account until we arrive at its systematic place, under the article **MELOLONTHIDÆ**. See also **COLEOPTERA**.

CHAILLETIACEÆ. A natural order of dicotyledonous plants, allied to *Terebinthaceæ*, *Rosaceæ*, and *Aquilarineæ*, containing three genera, and seven known species. Its essential botanical characters are: calyx persistent, five-cleft, coloured within, with an imbricated æstivation; petals five, alternate with the segments of the calyx, and arising from the bottom of it; stamens five, alternate with the petals; anthers roundish; ovary free, hairy, from two to three-celled; styles two or three, short, free or coalescing; fruit dry, two or three-celled drupes; seeds solitary, without albumen; embryo thick, with a short, superior radicle, and fleshy cotyledons.

The plants belonging to this order are trees or shrubs, with alternate, stipulate, ovate leaves, and axillary white flowers. They are natives of tropical regions, and are found in South America, and in the islands of Madagascar and Timor. The genera of the order are *Chailletia*, *Leucosia*, and *Tapura*.

Chailletia Toxicaria, or rat-bane, is a branching shrub, from six to twelve feet high, which grows on the mountains near Sierra Leone. It bears small white flowers, and yields a fruit the size of a pigeon's egg, which possesses poisonous properties. The kernel is used by the negroes for poisoning rats and mice. In other respects the properties of the order are not known.

CHALCEDONY. A mineral much in request in ancient times, and which appears to have derived its name from Chalcedon, a miner who first discovered it. Its basis is usually of a semi-opaque character; and if we may judge from the descriptions given by Pliny and some other of the early authors, it would rather appear that the gems they describe under this name were of a more beautiful character

than those we now employ. There are four well-known forms of the chalcedony; the first resembling a common flint, and is usually found in masses of two or three inches in diameter. Under this head we may place the oriental chalcedonies, which are the only ones of any value. They are found in vast numbers on the banks of the rivers in all parts of the East Indies. The second form is of a milky colour, and is of little value. It is principally found in South America. The third form is exceedingly dark and cloudy, and was known to the ancients by the name of smoky jasper. It is at the present time much used in Germany, and worked into the handles of knives. The fourth kind is usually of a yellow or red colour. It comes from the East Indies, and the Italians employ great quantities in the manufacture of their rosaries.

The dendritic chalcedonies, or mocko gems, are much prized as ornamental stones. The arborisations are black, red, brown, or green. The black are the most common, and most distinct; the red, on the contrary, are rarer, and are less distinct, and are named *corallines*, from the resemblance of the dendritic delineations to coral; and the green are rare, and much esteemed. These arborisations appear in some cases to be owing to iron, in others to manganese and iron. Dutens, Von Moll, Daubenton, Blumenbach, and Dr. Maculloch, maintain that many of them are of a true vegetable nature. Dutens says, that if the plants contained in chalcedony are extracted, and the fragments thrown on burning charcoal, a bituminous smell is exhaled; and Von Moll maintains, that chalcedony sometimes contains brown and green moss.

Lenz affirms, that the chalcedony found in the amygdaloid of Deuxponts, contains musci of different kinds, such as lichen *rangiferinus*, *confervæ*, and *byssi*. And Blumenbach says, in a letter to Baron Von Moll, that though he had hitherto disbelieved the occurrence of vegetable bodies in the dendritic variety of chalcedony, named mocko-stone, yet he must now admit that it does sometimes contain plants, apparently of the nature of *conferva*. He observed these in specimens from Iceland and Catherinenburg. The same celebrated naturalist maintains, that he found, in the interior of an agate, the fructification of an unknown plant, somewhat resembling the *Sparganium erectum*.

CHALCIDIDÆ. A family of very minute hymenopterous insects, belonging to the section *Pupivora* of Latreille, and forming Linnæus's section *Ichneumonones minuti*. This family is distinguished by the wings being almost entirely destitute of nervures, and the antennæ, which are strongly elbowed at the extremity of the long basal joint, are short, and composed of not more than thirteen joints. These minute creatures are amongst the most effective agents to be found amongst the insect tribes employed in the parasitic destruction of their larger brethren, the females being unceasingly employed in searching for and depositing their eggs in the bodies of other insects, almost every order being alike subject to their attacks. It is, however, to the destruction of the larvæ of lepidopterous insects that their labours are for the most part devoted. A very common instance of their proceedings may be observed in the chrysalis of the nettle-tortoiseshell butterfly (*Vanessa urticæ*), which is often to be seen, as it were, bored through with numerous small holes, whence, instead of the

perfect butterfly, an infinity of minute and beautiful little creatures have escaped. This circumstance seems not a little to have perplexed the old naturalists. How a creature, which ordinarily produced a beautiful butterfly, should, at certain times, produce myriads of other smaller insects, was one of those hidden secrets of the creation which they knew not how to fathom; and we find even the great Swammerdam mentioning it as "a thing very wonderful, that 545 flies of the same species were produced from the chrysalides of four butterflies, so that the life and motion of these four creatures seems to have transmigrated into those of the 545 others;" and even the philosophical Ray at first thought that it arose from some defect or weakness in the caterpillar which would prevent the perfect development of the butterfly; and therefore, in order that the maxim, "*Natura nihil frustra fecit*," should not be defeated, she stopped short, and formed them into more imperfect animals. And in the argument which he subsequently used in his admirable work, "*The Wisdom of God in the Creation*," against the doctrine of equivocal generation, we find the same learned author thus expressing himself:—"You will say, How comes this to pass? Must we not here necessarily have recourse to a spontaneous generation? I answer, No. The most that can be inferred from hence is a *transmutation of species*. One insect may, instead of generating another of its own kind, beget one of a different. *But I can by no means grant this*. I do believe that these flies do either cast their eggs upon the very bodies of the fore-mentioned caterpillars, or upon the leaves, upon which they feed, all in a string, while those hatching eat their way into the body, where they are nourished till they are come to their full growth. Or it may be, the fly may, with the hollow and sharp tube of her womb, punch and perforate the very skin of the caterpillar, and cast her eggs into its body. The discovery of the manner of the generation of these sorts of insects I earnestly recommend to all ingenious naturalists as a matter of great moment. For, if this point be but cleared, and it be demonstrated that all creatures are generated unequivocally of parents of their own kind, and that there is no such thing as spontaneous generation in the world, one main prop and support of Atheism is taken away, and their strongest hold demolished, they cannot then exemplify their foolish hypothesis of the generation of man and other animals at first, by the like of frogs and insects at this present day." In what a striking point of view do the arguments of this good man appear, now that it is known that the suppositions upon which some of them were founded so completely correspond with what takes place in nature; the only part of them not being found to be strictly correct being the idea, that these parasites laid their eggs on leaves which might be frequented by the caterpillars, an idea evidently derived from the general and incorrect principles to which the presence of blight is usually attributed, and to which we have already alluded in our article upon that subject.

These little animals, of which we probably possess 1500 British species, are highly beautiful in their form, and their colours vie with those of the humming birds. We find gold and purple, copper and green, intermingled in the most elegant order, thus forming exquisite microscopic objects, whilst many of them are highly singular in their appearance. In fact, they appear to be the counterparts of the cercopides

amongst the homoptera, possessing, like them, the power of leaping to a very great distance, although their legs are very seldom incrassated. This, however, is the case in the typical genus *Chalcis*, of which we possess several British species, but which, singularly enough, do not possess saltatorial powers, although their posterior femora are very large. The genera, of which the investigation has been greatly neglected until recently, are very numerous.

CHALK. This universally diffused substance is too well known to need any particular description of its external characteristics. We have manifest proofs, in our own country, that this deposit must have experienced very considerable changes in its geological arrangement by the action of water; for the vast beds of gravel which are still employed in the formation of roads, &c., have evidently been rounded by attrition, after their separation from the chalk by which they were originally surrounded. In England, chalk extends with little interruption from the coast of Yorkshire to that of Devonshire, while a series of hills extends from Wiltshire to the coast of Kent; and a branch from the centre of the latter ranges to the Sussex coast near Brighton. The Isle of Wight basin comprehends the district between Newport and that island on the north, Brighton on the east, and Dorchester on the west. In Europe, the chalk extends through France and Poland into Russia, and thence to the south of Sweden, is said to occur near the mouth of the Elbe, thence to Flamborough Head in Yorkshire, and thus completing a circuit which may be termed the chalk basin of Europe.

Chalk forms, by its extent and distinctive characters, one of the most remarkable mineral features of England. It would seem as if a considerable interval of time had elapsed between the completion of the original chalk beds and the deposit of others upon it; for the surface of the chalk at its boundary with the superincumbent layers, bears marks of having undergone, during that period, a partial destruction after it was consolidated. There is spread over it a stratum of debris, consisting chiefly of flints washed out of its mass. Moreover, the surface is irregularly worn into numerous cavities, of which many are deep and filled up with the same debris. At the junction of the chalk with the sand and gravel of the plastic clay formation, deep indentations are observed on its surface, which are sections of long furrows and cavities, apparently produced by the action of agitated water before it was protected by the covering of clay. The enormous quantity of chalk flint pebbles, completely rolled and rounded, which are found in the plastic clay to the south of London, show that the chalk itself must have been consolidated before that partial wasting of its upper strata by water. To this hydraulic action, Cuvier and Brongniart ascribe the irregular furrows and ridges on the surface of the French chalk, and the *Muedon breccia*. The immense scale on which this destruction was carried forward may be inferred from the vast extent of the English pebble beds. That a long period of time probably intervened between the deposition of the chalk and of its clay coating is rendered probable also by the total difference of the organic remains found in the two strata.

The band of chalk which stretches across the eastern and southern counties of England, from Yorkshire to Dorsetshire, is to be regarded merely as the western edge of a most extensive tract of this formation. Stretching from the Thames to the Don, the chalk

occupies the interior area of the great central basin of Europe. This concavity is bounded on the north by the primitive mountain districts of Russian Finland, Sweden, Norway, and Scotland; on the west by the transition and primitive chains of Cumberland, Wales, Devonshire, and Britany; on the south by the primitive mountains branching from the Cevennes in the centre of France, the Alps, with the various grand groups of Germany, as the Black Forest, the Rhingau and the Vosges, the Bohemian, Thuringian, Saxon, Silesian, and Carpathian mountains; on the east by the Ural chain and its branches. The chalk does not rest on the mountains themselves, but within the area which they circumscribe at a certain distance from them, an interior area may be traced, over which the substratum of chalk is believed to extend.

Cuvier and Brongniart represent the chalk deposit as forming a sterile soil, and adduce Champagne as a proof of its being in some cases uninhabitable. In our own country the population of the chalk district is certainly less dense than that of many other parts, but it is usually habitable, and to a certain extent productive. Indeed we may say that the chalk valleys are often in this country extremely fertile, of which the Kent and Surrey hop grounds, and the downs for pasturing sheep, afford examples. Beech is the tree best fitted for a chalky soil. The Chiltern Hills, in Oxfordshire, were anciently covered with woods and thickets of beech, which afforded harbour to banditti. The lower beds of the chalk formation are, with few exceptions, filled with water, which percolating from above is arrested by the subsoil of blue clay. Thus are formed the springs and rivulets which issue near the foot of almost every chalk hill.

It is remarkable that America, both South and North, seems to be destitute of chalk, Mr. Maelure asserting positively that it does not exist on that continent. Chalk is well known to have an earthy dull fracture, but it occasionally concretes into a hard limestone. This compact chalk has been used in building. As this formation is composed throughout of a series of homogeneous beds of a tender earthy limestone, it does not admit of stratiform subdivisions.

But the numerous beds of nodular flints, which lie alternately distributed through the greater part of its mass, form one of its most curious and essential features. They are constantly present in all the upper portions of the formation, but are frequently absent in the lower; affording a criterion by which the two may be distinguished. Hence the meaning of the terms *upper* and *lower* chalk.

The uses of this mineral are various. The more compact kinds are employed as building-stones, when they are used either in a rough state, or are sawn into blocks of the requisite size and shape; it is burnt into quicklime, and used for mortar in different countries; it is also employed in great quantities in the polishing of glass and metals, and whitening the roofs of rooms in the state of whitening; in constructing moulds to cast metal in; by carpenters and other artisans to mark with. When perfectly purified, and mixed with vegetable colours, it forms a kind of pastel colour; thus, with litmus, turmeric, saffron, and sap-green, it forms durable colours. The *Vienna white* known to artists is perfectly purified chalk. It is also used by starch-makers and chemists to dry precipitates on, for which it is peculiarly qualified, on account of the remarkable facility with which it absorbs water.

CHAMA. Lamarck, in constituting this genus, has separated from the Linnæan arrangement all such shells as have only a thick oblique transverse tooth, resembling a lengthened callosity, in general crenulated or grooved, fitting into a corresponding cavity in the lower valve. The shell is inequivalve, irregular, heavy, rough, scaly, or spinous, having the faculty of affixing itself to other bodies, or to each other in groups, by means of its lower valves. The apices are unequal and recurved; valves with two distinct distant lateral muscular impressions; ligament external and inserted. The characters of these shells, in some respects, ally them to the genus *Diceras*, and in others to the genus *Etheria*. They are, most of them, elegant shells, some with delicate waved or foliaceous valves, some with spines, and pleasingly coloured with yellow, pink, and brown. The animal possesses a suborbicular body, terminated on the upper side with a sort of hook-mantle slightly opened, the foot terminated at its extremity by a portion much narrower than the base; the superior lobes of the branchia very short. The following subdivision of this genus, though not exactly in unison with those of Lamarck, appear to us natural and well defined:—1st, The species that are irregular, inequivalve, without lunulæ, adhering by the left and largest valve, the two summits turning more or less in a spiral form, the left summit more prolonged than the right, as in the *Chama Lazarus*, and in the same division, those whose summits are prolonged nearly equally, as in the *C. gryphoides*. 2nd, The species subequivalve, subregular, with a distinct lunula, the summits but slightly spiral, adhering by either valve, as in the *C. arcinella*. 3rd, The species which are subregular, half-heart shaped, very inequivalved, the right valve much excavated, the left valve operculated, one conical cardinal tooth, smooth on one side, and fitting into a deep groove on the other valve; ligament as if double, the internal portion much thicker than the external, the muscular impression anterior and very long, as in the *Chama hemicardium*.

This genus is extremely difficult to characterise by any system of teeth or hinge, for each species presents a particular modification, nevertheless, the last division named is so peculiarly different from the others, that without any reference to the animal, it might well form a distinct genus.

These shells are found in all the seas but those of the north; in the southern seas they are more numerous than elsewhere. Eight or ten species are known in a fossil state. They are classed in the third class, *Acephalophora*; third order, *Lamellibranchiata*; seventh family, *Camacca*.

CHAMÆROPS (Linnæus). A genus of palms, commonly called the fan-palm. Linnæan class and order *Polygamia Diœcia*; natural order *Palmæ*. Generic character: flowers polygamous; spatha double, leathery, interior side bursting obliquely; floret sitting and bractiate; calyx three-cleft; corolla of three petals; filaments dilated at the base, and connected; stigma three, awl-shaped; berries three, one-seeded. This palm thrives best in sandy loam, and requires moist heat. It is found in the south of Europe, and all warm countries.

CHAMORCHIS (Richard). A single plant forming a new genus, formerly called *Ophrys Alpina* by Linnæus. Like other orchises it has tuberous roots, which are liable to be lost if not planted in turf, and kept in a station like their natural one.

CHAMPACA. The specific, as well as the Malayan name of the *Michelia*, found at Malacca and other places in that part of India. It is a lofty timber tree, and highly ornamental from its numerous yellow flowers, with which the spray is covered in autumn. It belongs to *Magnoliaceæ*.

CHARACEÆ—Chara family. A natural order of acotyledonous or cellular plants, containing one or two genera, and upwards of twenty species. They are aquatic, leafless, submersed plants, consisting of a central axis, from which proceed numerous whorled branches. The axis is composed of parallel tubes, which are either transparent and flexible, or encrusted with calcareous matter, so as to become opaque and fragile. The branches, or leaves, as they used to be called, are smaller tubes of a similar nature. The organs of reproduction in this family of plants are very obscure, but, according to the most recent observations, they appear to be of two kinds.

1. Globules, of a reddish or orange colour, the coats of which are composed of triangular scales, which are at first nicely fitted to each other, and afterwards separate, when the plant reaches maturity. On the margin these scales consist of numerous parallel, colourless, hollow tubes, containing minute orange-coloured bodies, analogous to the sporules of other cryptogamic plants, which are easily dispersed whenever the globules are in any way injured. It is to these little bodies that the globules owe their colour.

2. Minute, sessile, spirally striated, ovate nucules, which are enveloped in a membrane, have frequently five projecting points at the apex, and are filled with minute granular bodies at first distinct, but afterwards coalescing, and giving rise, when they germinate, only to a single plant.

These two sets of organs, the globules and nucules, which are found either upon the same or different plants, were long looked upon, even by botanists of the first eminence, such as Linnæus, Jussieu, Decandolle, and Brown, as being true stamens and pistils. Hence the plants were placed in the phænogamic or vascular division of vegetables, and were referred to the classes *Monandria* and *Monœcia*. The structure and habits of the characeæ, however, seemed to differ so much from those of the true flowering plants, that doubts were for a long time entertained as to the propriety of referring them to that division of the vegetable kingdom; and a more careful examination has led most botanists to believe that they ought to be considered a distinct order of cellular vegetables. In consequence, however, of the peculiarity of their organisation, it is not easy to trace their affinity to other cryptogamic tribes, and considerable difference of opinion at present exists on the subject. Professor Lindley considers them as allied to *Confervæ*, but has placed them amongst the *Muscoideæ*, or moss-like plants; while Dr. Hooker, has placed them beside the *Algæ* or sea-weed.

The chara tribe are remarkable on account of many of the species emitting a very disagreeable fetid odour, which does not seem to be dependent on the water in which they grow.

They are generally of a dull greenish colour, and have roots, which are usually attached to the bottom of stagnant pools of fresh or salt water. Their stems are delicate, slender, and sometimes jointed. They are frequently rendered hard and brittle by encrustations of carbonate of lime, which are formed on the

outside of the central tube, and are covered by a fine transparent membrane. These encrustations are not mere accidental deposits, depending upon the presence of some extraneous matter in the water in which the plants grow, but are formed by the vital energies of the plant, and probably perform an important office in the processes of vegetable life. The particles of calcareous matter, when carefully examined under a high magnifying power, exhibit various beautiful arrangements, at one time extending in the form of parallel lines along the stem, and at other times forming oval groups, which are attached to each other like the beads of a necklace. While examining these in the *Chara vulgaris* and *hispida*, Sir David Brewster found that the plants became phosphorescent when placed on heated iron, so as to display their entire outline in the dark. He also ascertained that each mass of calcareous matter consisted of minute particles, which possessed double refraction, and had regular neutral and depolarising axes.

An important and highly interesting physiological phenomenon has been noticed in some of the chara family by Professors Amici and Blainville. On examining the stems of some of the species, more especially the *Chara vulgaris*, they observed two liquid currents, one ascending, the other descending, circulating in the same tube, without being separated by any partition which could insulate them. The reality of this phenomenon was completely confirmed, by their observing distinctly that certain molecules of one of the currents, being attracted by the other moving in an opposite directing, were sometimes carried along with it. The rate of motion is stated to be about two lines in a minute. The motion is stopped by pressure, laceration of the tube, or by the application of a drop or two of brandy.

The characeæ are met with in all regions of the globe, in Europe, Asia, Africa, and America, but they are most abundant in temperate countries. Some of the species found in Iceland are said to grow even in the hot springs of that island.

Nucules of charas, under the name of *Gyrogomits*, are found in the marl deposits of the Forfarshire lakes, and in the chalk of Montmartre. From these fossil remains, it would appear that the characeæ were formed more recently than the ferns and palms.

Trout are said to thrive well in water where charas grow, probably on account of these plants attracting a great number of insects.

The characeæ do not possess any particular known properties which would render them useful either in a medical or economical point of view.

The only genera of the order are *Chara* and *Nitella*. The latter genus is said to differ from chara in being always transparent, and free from calcareous matter, in having a single-jointed stem, and the globules and nucules on separate plants. These characters are, however, by most botanists not considered sufficiently constant, and the two genera are therefore generally described under the common name of chara. There are eight species natives of Britain, and of these *Chara translucens* is the largest and brightest coloured. *Chara vulgaris*, from its roughness, is used, like some species of equisetum, for scouring or polishing.

CHARADRIUS—Plover. A very interesting genus of birds, belonging to the order *Grallidæ*, of which the details will be found under the article PLOVER.

CHARICLEA (Stephens). A beautiful genus of lepidopterous insects belonging to the family *Noctuidæ*, and having for its type the rare peach blossom moth of British collectors, *Noctua Delphinii* of Linnæus. The anterior legs are armed at the extremity of the shanks with two shining horny spines; the wings are very gaily ornamented with purple markings, and are about an inch and a quarter in expanse.

CHARLOCK is the English name of the *Sinapis arvensis* of Linnæus. It is a tetradynamous annual, and belongs to the natural order *Cruciferae*. No weed, except the thistle perhaps, gives the English farmer more trouble, nor causes more injury to his crops, than this. It springs up with, and ripens seed before the corn; consequently much seed is scattered on the ground by the sithe and sickle in gathering the crop. Although an annual, it is not easily extirpated, as the seed will lie uninjured in the soil for years; and when the farmer has lost sight of it for several consecutive seasons, it will at last come up so abundantly, that the crop of corn will be choked by the plant, and covered with the yellow flowers of the charlock.

CHARLWOODIA (Sweet). A genus of ornamental trees, natives of New Holland and New Zealand, named in honour of G. Charlwood, F.L.S., an intelligent English botanist. Linnæan class and order *Hexandria Monogynia*; natural order *Asphodeleæ*. Generic character: calyx bell-shaped, regularly six-cleft, withering; stamens inserted in the throat of the corolla; filaments awl-shaped, smooth; anthers versatile, cleft at the base; style filiform; stigma three-lobed; berry globular, three-celled; cells full of seeds. There are four species described; two are common in our collections, "one with pale purple, another with blue flowers; they should be kept in a very warm greenhouse, as they are tender, or in a cool part of a stove, and may be increased by cuttings of the young side shoots. The cuttings must not be deprived of their leaves, but put into pots filled with an equal mixture of light loam, moor earth, and sand; which compost is also the best soil to grow them in." *Sweet*.

CHARÆAS (Stephens). A genus of lepidopterous insects belonging to the family *Noctuidæ*, having the wings more or less notched; the palpi are very short, and the antennæ of the males more or less comb-shaped. The genus includes five British species which vary considerably in structure, amongst which the *Phalæna bombyx graminis*, Linnæus, or the antler moth, is placed. This insect is exceedingly destructive in pastures, feeding upon grass; and it is recorded that in Sweden, towards the middle of the last century, its ravages were so extensive that whole meadows appeared white and dry, as though a fire had passed over them. In England also, at various but uncertain periods, different parts of the country, especially the northern counties, have suffered from its ravages, "spots of a mile square were totally covered by them, and the grass devoured to the root." Mr. Wailes has recently published some interesting observations upon this insect in the Entomological Magazine, noticed upon Skiddaw: at least fifty acres of which were so completely devastated and the line of devastation so clearly marked, that even from the town of Keswick the progress of the larvæ down the mountain could be distinctly noted. Vast quantities of rooks flocked to the spot to feed upon the delicious repast afforded by these eaterpil-

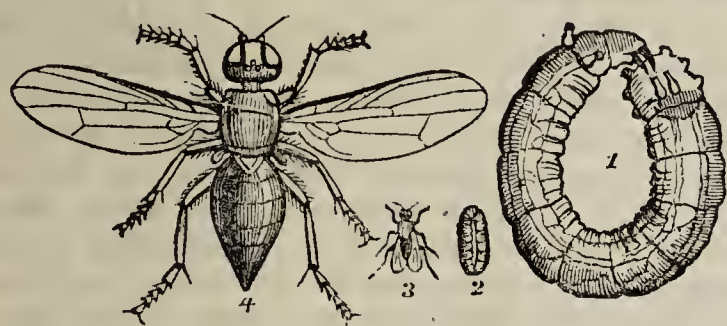
lars; but so greatly was the vegetation destroyed, that even several years afterwards the extent of their ravages was distinctly visible. "Of course," adds Mr. Wailes, "the quality of the newly-grown herbage was materially improved, thus affording another instance of indirect advantages derived from insects;" and Mr. Haworth in like manner observes, "Perhaps this apparently destructive scourge of the Swedish pastures (though happily not of our English ones) is of more use in the great economy of nature than we are aware of, by preventing the almost total suffocation and consequent destruction of the flowering plants, in giving them an occasional season in which they may recover themselves to become the food, the necessary food perhaps, of many insects, &c., which would perish whenever that became extinct."

The eaterpillar is of a brown colour with yellowish streaks on the sides and back. In the month of June it changes to a shining brown ehrysalis, and the moth appears in about a fortnight, being of a brown colour, and having a long pale line along the upper wings united to two large pale spots in front, and branching behind into three oblique teeth. We have, however, met with it later in the year, having captured it at the middle of August, both upon the Wrekin in Shropshire and Snowdon. It seems indeed to frequent mountainous districts, and contrary to the general habits of the family, we noticed it flying with great velocity in the middle of the day. We mention this because Mr. Wailes has stated some curious facts to which it is opposed. He noticed these insects one morning, about eight o'clock, flying in swarms over old pastures; on returning to the spot, a couple of hours afterwards, with his fly-net, not one was to be seen. The next morning, however, he was early on the spot, but then also not a solitary moth was to be seen; at half past seven he was about to return, "when suddenly the whole field, as far as the eye could reach, was once more the scene of their gambols, the eye became bewildered with their motions, they were lost in the mazes of their evolutions. Sudden, however, as their appearance had been, their disappearance was equally so, as with one general consent at about half past eight they again settled, and their flight for the morning being over, scarce a solitary specimen was any where to be seen. The moths flew about three or four inches from the ground, and apparently very seldom alighted, but threaded their way most dexterously amongst the long culms of the grasses."

CHAULIODUS. A genus of soft finned fishes with abdominal fins, belonging to the pike family. There is only one known species, an inhabitant of the waters of America, it is of a bright green colour, and about a foot and a half long, the muzzle is very short, but the gape extends as far as the eyes, and the teeth are strong and powerful, especially two crooked ones in each jaw; its habits, and, indeed, its characters are very imperfectly known.

CHEESE-HOPPER or **CHEESE MITE**. A small white fleshy grub of an elongated form, often found in decayed cheese, and which is the larva of a pretty two-winged fly known by the systematic name of *Piophilæ* (*Tyrophaga*, K.) *casei*. Of this insect the immortal Swammerdam has left us an interesting account, and although to unthinking persons it may appear to be a frivolous subject of inquiry, we find this illustrious philosopher affirming "that the limbs and other parts of this worm are so uncommon and

elegant, and contrived with so much art and design, that it is impossible not to acknowledge them the work of infinite power and wisdom to which nothing is hid, nothing impossible." It has been a common error that these insects were bred spontaneously from the cheese, and epicures accordingly do not hesitate to eat them with great goût, thinking them formed from the best part of the cheese, whereas they are produced from eggs deposited therein by the parent fly. These larvæ are long, cylindrical, and composed of twelve rings, the first of which is furnished with two small bent hooks of a black colour, which serve not only as teeth, but for feet also, the insect having no other organs employed as legs. The terminal segment of the body is covered with a variety of prominent tubercles and little cavities like wrinkles, of which we shall presently see the use. In our article CERCOPIDÆ we have alluded to the leaping power of this insect, and our figure will give an idea of the manner in which it prepares to make a spring.



1, the cheese-hopper preparing to spring.
2, the insect's natural size.
3, 4, the fly to which it is transformed: natural size and magnified.

When this larva prepares to leap it first erects itself on its anus, in doing which it is greatly aided by the prominent tubercles of the terminal ring, which enable it to maintain an equilibrium. It then bends itself into a circle, and having brought the head towards the tail it stretches out the two hooks of the mouth, fixing them into the two cavities at the extremity of the body. It then contracts the body from a circular to an oblong figure, the contraction extending in a manner to every part of the body. It now suddenly and with very great violence lets go its hold, the noise produced by its hooks being very perceptible, and in this manner the leap is effected, being in fact similar to the mode employed by the salmon when they wish to pass over a cataract or salmon leap, as it is termed. Swammerdam saw one, whose length did not exceed a quarter of an inch in length, leap out of a box six inches deep, that is to a height more than twenty-four times greater than the length of its own body, but they will leap much higher. Here we cannot but admire the powers given by nature to different creatures, and their limitations, to answer different purposes, and not for mischief to mankind. If for instance a power of motion, proportionably equal to that possessed by this insect, had been given to the serpent tribes, how much more terrible would they not have been rendered then, than they are with their present capabilities? A viper would throw itself nearly a hundred feet upon the traveller, and the rattle-snake several hundred. Swammerdam, after giving a minute account of the external and internal anatomy of this creature, observes, "Now let the sharpest geniuses, and men of the greatest penetration and learning, judge if a creature on the fabric

of which there plainly appears so much art, order, contrivance, and wisdom, nay, in which is seen the hand itself of the Omnipotent God, could possibly be the production of chance or rottenness." The female fly is provided at the extremity of the body with a very fine retractile borer wherewith she pierces the cheese, and is thereby enabled to deposit her eggs in the wound thus made. Shortly after which the grubs are hatched, and feeding upon the cheese cause it to decay; the fine powder which we perceive, and which is so highly prized by the gourmand, being nothing else but the excrement of these grubs, which, when they have acquired their full size, desert the cheese, and in three or four days they lose all motion, grow stiff, become hard, and contract their bodies into an oval mass not more than half their previous length, within which the real pupa is inclosed, this insect undergoing the coarctate kind of metamorphosis, like the majority of dipterous insects. After remaining some time in this state, the chrysalis becomes of a black colour, and the inclosed nymph breaks that part of the outer covering which defends its head into two parts, and at the same time throws off from every part of the body a thin and slight membrane which it leaves within the old case. At first the wings are scarcely perceivable, the insect, however, runs about very quickly, and shortly afterwards the wings are by degrees extended until they assume their full size, when the insect is fitted for pursuing its duties, which almost entirely consist in the reproduction of the species. The fly is about the size of the common domestic fly, of a shining blackish green colour, the wings transparent and shining, and the legs varied with ochreous and black.

CHEILODACTYLES. A genus of spinous finned fishes, belonging to Cuvier's third family *Sceinoides*, and bearing some resemblance to the perch family. They have the body oblong, the mouth small, numerous spinous rays in the dorsal fin, and the inferior rays of the pectorals continued in a membrane. There are several species, the greater number of which are inhabitants of the eastern seas.

CHEILODIPTERA. A genus of spinous finned fishes, belonging to the perch family. They are all of very small size, and found in the warmer seas of the east.

CHEIMATOBIA (Stephens). A genus of lepidopterous insects, belonging to the family *Gometridæ*, and remarkable for their appearance in the winged state in the depth of winter. Of these the type is the *Phal. geom. brumata* of Linnæus, an insect of very plain appearance, measuring about an inch in expanse, of an ashy brown colour, with nearly obsolete darker waves. It is very common in the neighbourhood of London, and may be seen flitting about the leafless hedges at dusk or by lamp-light, in moderate weather.

CHEIROPTERA—winged hands. The first family, or sub-order, of Cuvier's great order *Carnassiers*, or mammalia, which feed upon animal matter. Their most remarkable characters, and the one from which they obtain their name, is that of having the extremities, the arms especially, furnished with membranes, by means of which the animals are enabled to fly; although, in a manner much more awkward than that of birds. A particular account of the action of those singular creatures, as well as of the habits of the leading species, has already been given in the article *BATS*. Hence it will be necessary, in this place, to

give only a synoptic table, for the sake of reference, to the different genera. There are two tribes in the family, the bats properly so called, and the flying bats; and the first admits of sub-division into two groups.

FIRST TRIBE.—Bats properly so called.

First group, chiefly animal feeders.

Genus 1, *Vampires*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{5}{5}$. Canines in lower jaw angular, roots touching.

Genus 2, *Phyllostoma*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{5}{5}$. Canines in lower jaw parallel.

Genus 3, *Glossophagus*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{7}{6}$. Canines in lower jaw parallel.

Genus 4, *Morops*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{6}{6}$. Inferior membranes very long, tail of mean length.

Genus 5, *Vespertilio*. Teeth; incisors $\frac{4}{6}$, canines $\frac{2}{2}$, grinders $\frac{4}{4}$.

Genus 6, *Plecotus*. Teeth; incisors $\frac{4}{6}$, canines $\frac{2}{2}$, grinders $\frac{5}{6}$.

Genus 7, *Nycteris*. Teeth; incisors $\frac{4}{6}$, canines $\frac{2}{2}$, grinders $\frac{4}{4}$.

Genus 8, *Rhinopoma*. Teeth; incisors $\frac{2}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 9, *Molassus*. Teeth, incisors $\frac{2}{2}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 10, *Myopterus*. Teeth; incisors $\frac{2}{2}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 11, *Taphazous*. Teeth; incisors $\frac{2}{4}$, canines $\frac{2}{2}$, grinders $\frac{5}{5}$.

Genus 12, *Noctilio*. Teeth; incisors $\frac{4}{2}$, canines $\frac{2}{2}$, grinders $\frac{4}{4}$.

Genus 13, *Nictivorous*. Teeth; incisors $\frac{4}{2}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 14, *Stenoderma*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{4}$.

Genus 15, *Rhinolophus*. Teeth; incisors $\frac{2}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 16, *Megaderma*. Teeth; incisors $\frac{2}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Second group, in great part at least, feeders upon vegetable substances.

Genus 17, *Pteropus*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{5}{6}$.

Genus 18, *Cephalotus*. Teeth; incisors $\frac{2}{2}$, canines $\frac{2}{2}$, grinders $\frac{4}{6}$.

Genus 19, *Cynoptera*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 20, *Harpya*. Teeth; incisors $\frac{2}{6}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

Genus 21, *Macroglossus*. Teeth; incisors $\frac{4}{4}$, canines $\frac{2}{2}$, grinders $\frac{4}{5}$.

SECOND TRIBE.

One genus, *Galcopithecus*. Teeth; incisors $\frac{2}{6}$, canines $\frac{2}{2}$, grinders $\frac{1}{1}$.

In the above tabular statement, the whole of the incisive and canine teeth are mentioned, but only half the grinders, or those on one side of each jaw, the upper number referring, in all the statements, to the upper jaw, and the under number to the lower.

CHELIFERIDÆ. A family of small annulose animals, belonging to the class *Arachnida*, and to our order *Adelarthrosomata*, having very much the appearance of minute scorpions destitute of tails, the body being oval, depressed, and narrowed in front; the palpi as long or longer than the body, in the form of arms, each terminated by a double claw; the legs are of equal size, and short, being terminated by two hooks, and the eyes (two or four in number) are

placed at the sides of the thorax; the breast is not furnished with the remarkable toothed appendages to be observed in the scorpions. These animals, being destitute of lungs, breathe by means of lateral tracheæ or spiracles along the sides of the body. By Linnæus the only species of the family known to him, was at first arranged with the mites (*Acarus*), and afterwards with the harvest-men (*Phalangium*), from all of which however it is abundantly distinguished, and accordingly Geoffroy established for its reception the genus *Chelifer*, whilst Fabricius placed it amongst the scorpions. Illiger again, neglecting the step taken previously by Geoffroy, formed the genus *Obisium* for this group; and still more recently Dr. Leach has not only adopted the genus *Chelifer* of Geoffroy, but also that of *Obisium* for several of the species which differ from the true chelifers in some respects, a step which appears to us to have been improperly taken, as it is evident that Illiger's genus was strictly synonymous with Geoffroy's, both having the *Chelifer cancrroides* for the type.

As a family, these little animals are highly interesting in respect to the general distribution of the class to which they belong, exhibiting, as they do, the appearance of one group, whilst they in reality belong to another quite distinct. They are found, in general, in moist situations in moss under stones, flower-pots in gardens, and in unfrequented parts of buildings; they also get into old books, herbariums, &c., where they feed upon other more minute insects, such as *Atropos lignarius*, *acar*i, and occasionally even venturing to attack the domestic fly, of which circumstance various notices will be found in the Magazine of Natural History. We have likewise captured the largest species, which we have hitherto seen of the group, under the bark of trees in Windsor forest, in the act of devouring even the hard-cased beetle (*Bitoma crenata*). Goetze also has fed them with aphides.

According to Linnæus, these animals occasionally introduce themselves beneath the skin, producing a painful swelling, and on the information of Dr. Bergius, he states that a peasant had his thigh pierced during the night by one of these insects, which formed by the morning a pustule of the size of a nut, which was very painful. These insects creep rather quickly, and will, when disturbed, run sideways like a crab. Roesel states that the female lays small eggs, of a greenish-white colour, which she forms into a mass side by side, and, according to the elder Hermann, she carries this mass about with her beneath the body, like some spiders.

The family comprises only the two genera mentioned above, of each of which there are various British species. The type of the family, *Phalangium cancrroides* of Linnæus, seldom exceeds one-eighth of an inch in length.

CHELONE (Linnæus). A genus of American ornamental perennial herbs, of late years introduced into our flower gardens. Linnæan class and order *Didynamia angiospermia*; natural order *Scrophularia*. Generic character: calyx five-parted, persisting; corolla bell-shaped, bell-shaped, limb two-lipped, the upper one two, and the lower three-lobed; stamens, rudiments of five, smooth or bearded; anthers incumbent and oblong; style bearing a headed or bilamellated stigma; capsule two-celled, two-valved; margins of the valves inflexed; seeds margined or naked. The chelones are pretty showy

plants, and all grow freely in any soil. They are easily propagated by cuttings, placed under a hand-glass.

CHELONIA. The first order of reptiles in Cuvier's arrangement. Some of them are land animals, and others aquatic; the former being known by the general name of tortoises, and the latter by that of turtles. They are all four-footed animals, or quadrupeds; and they are encased in a coat of armour, usually called a shell, and which adheres to the sternum and the ribs.

They have the heart with two auricles, but only one ventricle, though the latter is divided into two chambers or cells, by an incomplete partition, which admits of a communication between the one and the other. The blood, which returns from the circulation over the body, is received into the right auricles of the heart, and that from the lungs into the left; but owing to the imperfect division of the ventricle, the circulation is incomplete, as the blood which has undergone the action of the air in passing through the lungs, is in part mingled with that which comes from the body, and the mixture is returned to the system, so that only a portion of even that which passes through the heart is subjected to the renovating influence of the air in the lungs.

In all animals, even those which have the double heart most perfect, only a limited portion of the blood passes through the heart at each pulsation; and the inferior vertebrated animals, which have a slow circulation and low temperature, have only a portion of that which passes through the heart sent to the lungs; this portion being less and less in proportion as the general action of the system is more languid.

The structure of a chelonian reptile can be perhaps best explained by first attending to the most striking part of its external appearance, the double buckler in which its body is encased. This principally consists of two parts, a spinal and a sternal one; the first the shield on the back, and the second the breast-plate on the under part of the body. Both of these consist of a number of pieces, which varies in different species; and the forms of the plates, and the modes of their junction with each other, are the foundations of some of the trivial characters.

A row of these plates ranges down the back of the animal, and there are others ranged along the sides of these which, with them, form the disc of the shield. Of these there are sometimes as many as eight pairs; and towards the margins of the breast-plates they are surrounded by others, usually about from twenty-one to twenty-five, which form the margin of the shield. They are more irregular in their forms than the plates which compose the disc, and are generally oblong; the lateral plates are united by sutures to each other, and also to the dorsal plates, which last are fastened, but not soldered, to the vertebra. When the different plates or pieces which form the shield, rise in a sort of ridge in the middle, they are said to be *carinated*, or keeled; when they are depressed in the middle, they are said to be *furrowed*; when they rise uniformly to the middle, they are called *convex* or *sub-convex*, according to the degree of elevation; when they lie over each other like slates on a roof, they are *imbricated*; and when they have the margins toothed or jagged, they are *serrated*. The pieces which form the breast-plate or external buckler, are usually about nine in number. They are more or less firmly attached to the marginal plates of the

shield along the sides; and in general none of the parts which form these two bucklers, or are attached to them, have any motion.

There is one opening between the shield and breast-plate anteriorly, through which the head and fore extremities of the animal are projected; and another at the opposite end, for the posterior extremities and the tail.

The anterior extremity of the blade-bone is articulated with the shield, and there is a connexion with the opposite extremity, and the breast-plate is united by a connexion which bears some slight resemblance to a clavicle. Thus the extremities, which bear the weight of these animals, are not articulated directly on the spinal column, any more than they are in the higher orders of vertebrated animals.

In some species the terminal plates, or pieces of the breast-plate, are capable of a slight motion, so as completely to shut in the head and extremities, and protect them from the attacks of every enemy except man. Those which have this structure and motion of the shell are called "box tortoises."

In the greater number of the species, the motion of the extremities is exceedingly slow; but the power of moving other bodies is great in proportion to the slowness of the rate, for one of the larger land tortoises can get along at its sluggish pace, with the weight of two or three men standing upon its back. The vertebræ of the neck are beautifully articulated; and although the range of space over which it is capable of moving is very limited, there is perhaps no animal which commands with so much certainty and steadiness the space over which it can move.

There is a sort of frame-work of osseous pieces, which bears some resemblance to the sternal or cartilaginous portion of the ribs; but this has no motion, nor indeed is there motion in any part of the animals, except in the head and neck, the tail and the extremities.

The osseous portion of the chelonia is immediately covered by the integuments, the scaly plates on the skin, without any intervening muscles, which are all placed on the inside, so that in some respects these appear to be animals turned inside out, or at all events with the substantial part of the skeleton without side the organs of motion; and they are thus in some respects intermediate between the vertebrated and articulated animals. There is even a resemblance to birds, though a very slight one, in the articulation of the anterior extremity: there is a large bony haunch which extends backwards, from the articulation of what may be termed the humeral joint, and which, in form and position, bears some resemblance to the coracoid bone in the feathered tribes, only it does not abut on any solid support at its posterior extremity, either on the breast-plate, or on the bony frame-work above alluded to. It appears merely to afford the shoulder a more firm imbedment than it could otherwise have.

The lungs of the chelonia are contained in the same cavity with the rest of the viscera; as is the case in all reptiles, they extend into the abdomen, but they are separated from the abdominal viscera, properly so called, by a duplicature of the peritoneum. In consequence of the structure of the shelly covering, which precludes the possibility of breathing in the ordinary manner, by the action of an elastic thorax and a diaphragm, the breathing of the chelonia is very peculiar, and has more resemblance to a sort of

drinking than to ordinary breathing. The whole is performed by the action of the mouth, at least in all the species which have the scaly plates immoveable. The os hyoides, or bone of the tongue, is the principal organ of support in the performance of this somewhat curious process. When these creatures breathe, they do not open the mouth, as is the case with most of those animals which require a more frequent and copious supply of air. On the other hand, they keep the jaws firmly closed (and there are no animals which can close them more firmly), and perform the respiration by means of the action chiefly of the tongue. By depressing the os hyoides, they open the nostrils, and at the same time form an open cavity of considerable extent in the mouth, into which the air rushes. Then, when the cavity thus formed is filled with air, the os hyoides is raised, which closes the apertures of the nostrils, and at the same time, by lessening the cavity of the mouth, forces the air into the lungs, which of themselves perform the operation of expelling the air after it has performed its function.

It will be seen that this species of breathing has much more of a voluntary process than that of the higher animals, which require the operation much more frequently, and that thus it can be suspended at the pleasure of the animal. The same kind of respiration takes place in the Batrachia, and indeed to a greater or less extent in the whole class of reptiles. See REPTILES.

In the armature of their jaws the chelonia have some resemblance to birds, and indeed there are many more structural coincidences between the two than we would be prepared to expect in animals which are so different both in their appearance and their habits. Generally speaking, the jaws of the chelonia are covered with horny plates, not very unlike the mandibles of birds; but in the texture of this horny substance there appears to be a general law in the species—those which have the bucklers of the firmest texture have the coverings of the jaws firmest; while the soft tortoises, which have only a thick parchment-like skin for their covering, have the jaws covered with a similar skin. When we say “shell,” in the case of these animals, we must not be understood to mean shell properly so called, that is, shell containing salts of lime, which can retain their form after all the animal matter has been destroyed by burning; for even the most compact of their coverings, the shell of the hawk’s-bill turtle, the true tortoise-shell, of which so many trinkets, and other little ornamental matters, are made, approaches much more nearly in substance to horn than to any thing else with which we can compare it. The chief difference, indeed, is in the texture, which is not fibrous, but rather composed of small laminae, which admit of division with almost equal readiness in all directions. The substance to which it approaches most nearly is that of hoofs, more especially the hoofs of antelopes. But it is really horn, and can be softened and treated exactly in the same manner as other horny substances. There is a gradation in the production of horny substance, which is worthy of more careful examination and study than it has hitherto met with. The loosest texture with which we are acquainted is that of baleen, on the plates of whalebone in the large Greenland whale. This substance is little else than soldered hairs, and hairs not very closely or firmly soldered, as they can be very easily separated from each other, though even these are more easily

separated into plates than into fibres. From them there is a gradation; and it is not a little singular that we meet with the other extreme of the series in an aquatic animal, the hawk’s-bill turtle, and also that the firmness of texture in this substance appears to be in proportion to the sluggishness of living action in the animals in which it is found. It is also worthy of remark, that the animals in which this substance is found are tenacious of life, very much in the ratio of the firmness of the substance.

Perhaps when we consider the matter physiologically, we ought to be prepared for expecting this. The principle of life in animals, of what class soever they may be, is a principle at variance with or opposed to the principle by which substances are brought into contact, and retained there—to all the attractions of gravitation and aggregation, in short; and we find that, in all animals, indeed in all organised beings, the departure from the common homogeneous structure, which matter, in obedience to those laws which have no principle of life in them, invariably assumes, is always in proportion to the energy of living action in the animal or the vegetable. The lowest, that is the least energetic in life, of vegetables and of animals are the most uniform and jelly-like in their structures; and the farther that we ascend in the scale of being, we find that there is always the more organisation. We find also that, in proportion as the organic being departs more from the ordinary laws of inorganic matter, it costs it the more labour to maintain the life. The higher animal must breathe frequently; and its blood cannot pass a second time into the circulation, or be able to perform its functions in the body, without being fully and freely exposed to the action of the renovating atmosphere; while, in those creatures in which life is less energetic, the action of a limited portion of the blood suffices, and even that may be suspended for a considerable time at the will of the animal, and is all but entirely suspended when they are in a state of hybernation. Even when they are not in a state of absolute hybernation, these animals can be kept alive for a considerable time without respiration. Some of them have lived for at least a month with the jaws firmly tied together, and the nose sealed up with wax, in which state they of course could neither eat nor breathe. As they have not much free action of air in the mouth, they have little voice, and the little which they do have is a sort of murmuring hiss produced by the violent compression of the lungs by those abdominal muscles which they use in expelling the air from these organs.

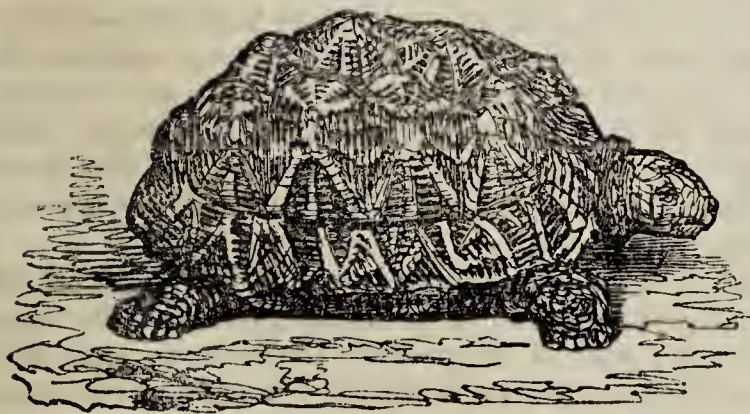
In the mode of bringing forward their eggs to the period when they are fit for deposition, these animals have some resemblance to birds; but the albuminous or white part of the egg does not coagulate with heat. The covering of their eggs also differs considerably from that of the eggs of birds, the hardest having more resemblance to indurated parchment or vellum than to common egg-shell.

Though some of them are inhabitants of temperate climates, and many take up their abodes chiefly in the waters, or in muddy places where the temperature is always low, yet they are all unable to bear extremes either of heat or of cold; and there are certainly few species which do not, during some part of the year, seek the mean temperature by digging into the earth, or burrowing in the banks. It is even probable that some of the marine species plunge to a considerable depth at some seasons of the year, and remain there,

suspended in the water, in a state of total inaction. The repose of the inhabitants of the sea is rather an obscure subject; but it is tolerably well ascertained that several species of surface fishes remain for a time suspended at considerable depths; and we know that several batrachian reptiles, the common frog for instance, spend their winter in the crevices of springs, entirely cut off from the atmosphere. While in this state they have the mouth and also the nostrils completely shut, so firmly that the mouth cannot be opened without almost a fracture of the jaws, until the animal regains its sensibility; and hence the popular opinion that, during a certain part of the year, the lips of frogs grow together, so that when they cease to feed they cease to have any opening of the mouth.

The chelonia resemble batrachian reptiles in several particulars, and in none more than in the form of the mouth, and the force with which they can close the jaws upon each other. Their temporal muscles are indeed remarkably powerful; and though a common turtle has no teeth, it can bite a pretty thick rope easily in two, or tear it in pieces. From what is known of the length of time that they can live exposed to the atmosphere with the mouth closed and the nostrils shut up, it is reasonable to conclude that they are capable of living much longer in the water in the same inactive state. Not only the shelly covering, but the whole of the integuments of the marine chelonia are better adapted for resisting the action of water than that of the atmosphere; and this is another reason which renders it at least probable that they follow the general law of the family in hybernating for a portion of the year. Many of their general properties are, however, common to the whole class, and can be more briefly as well as more clearly explained in the general article. We shall therefore devote the remainder of the few remarks to be made here to some notice of the several genera or sub-genera, into which naturalists have divided the family.

SEA TORTOISES, or TURTLES (*Chelonia*). The species included in this genus are the largest in size, and some of them are the most valuable to man in the whole tribe. They have their shell too small for allowing the head and extremities to be entirely withdrawn within it. Their feet, especially the anterior ones, are much longer than in the land tortoises; their terminations are flattened, and the toes united by membranes, so that they form a sort of fins or swimming paws. The two first toes of each foot have pointed nails, which are liable to drop off at a



certain age. The different pieces of which their shield is composed do not join each other by sutures, so as to form a continuous shell, like that of the land genera, but have portions of cartilaginous substance

between them. The marginal pieces are in part separated from each other, so as to form a series of lobes which correspond in number to the sternal ribs. From this peculiarity of structure, these animals are not perfectly rigid; their bodies "give" a little, which of course assists them in making their way through the water. This genus contains seven or eight known species, of which we shall mention only some of the more important.

CHELONIA MYDAS, common green Turtle, or eatable turtle. Of all the chelonian reptiles, this is deservedly held in the highest esteem, from the very nourishing and palatable food which it affords to the human race. It is also one of the largest of these tribes, and it is not less interesting from its habits and manners, than from its utility as an article of diet.

A full-grown turtle often measures six or seven feet in length, from the nose to the tip of its short tail, three or four feet in breadth, and nearly as much in thickness at the middle of the body. It sometimes weighs eight hundred pounds. The body appears of an oval form, and the head is of considerable size in proportion to the body. The tail is short and thick. The feet are long, and much better adapted to the action of swimming than that of walking. The head, feet, and tails, are covered with scales. The breast plate is shorter than the shield, and has twenty-three or twenty-four plates disposed in four rows. The prevailing colour of this turtle's shell, when in its usual situation, is bright brown, with spots of a yellow colour, and when the shell becomes dry, the brown assumes a darker hue.

This species frequents the coasts both of the islands and continents of the inter-tropical regions, and is found in great abundance both in the East and West Indies. It sometimes enters the mouths of large rivers, and occasionally goes to some distance from the shore, into the sheltered woody parts of the country. It swims with great facility, keeping its head and part of its shell above the surface of the water; but when it fears the approach of danger, or seeks its prey among the rocks, it dives to the bottom, and may be seen browsing at its ease among the weeds. It is said, however, that it does not dive very readily, as the specific gravity of its body but little exceeds that of the salt water. When it quits the water, its motion on the land is rather a scramble than a walk, and resembles that of seals and walruses among quadrupeds, except that it is much slower.

The great purpose for which turtles go on shore is to deposit their eggs in the sand. This process is generally begun in the month of April, and takes up several weeks, as the eggs are laid at intervals of about fourteen days. When preparing to lay her eggs, the female turtle digs a hole about two feet deep, a little above high-water mark, and into this cavity she drops about a hundred eggs at one time. While thus employed, her attention is so completely taken up with the business for which she has come on shore, that a person may easily approach her from behind and catch the eggs as they are let fall; but if disturbed before she begins to lay, she quits the place, and seeks a more secluded spot. After having deposited all the eggs which she is to lay at one time, she scratches the sand over them, and leaves them to be hatched by the heat of the sun. The eggs of this species are round, about the size of a tennis ball, and covered with a white skin resembling parchment. It is said that that part of turtles' eggs, which is analo-

gous to the albumen or white in the eggs of birds, does not coagulate by the heat of boiling water.

As the female turtle lays her eggs at three or four times, with intervals of about a fortnight, the young are of course hatched at different periods, the eggs of each laying require about three weeks before the young are ready for extrusion. The little animals are of the same shape with their parent, but have only a soft covering instead of a shell. As soon as they are released from their confinement, they make directly for the water; and though this be sometimes at a considerable distance, they shape their course towards it in a straight direction. But a small proportion of them, however, in general reach their natural habitation. Great numbers of them are seized by various predacious animals, especially cormorants and other large birds, which hover about the shore from May to September, for the purpose of seizing such a desirable prize.

The individuals of this species are often found collected into numerous groups, though it does not appear that they have much enjoyment of a social intercourse, but are rather attracted to the same place by the abundance of their natural food which it affords. During the coupling season the male and female seem warmly attached to each other, and are said to continue together for near a fortnight.

To what age the green turtle is capable of living, were it to remain unmolested, cannot be ascertained; but it is conjectured, by those naturalists who suppose the age of an animal to depend upon its size, and the number of years required for attaining its full growth, that this species must live for at least a century. We shall see hereafter that this is no uncommon age for species of a much more diminutive size.

Even in the time of Pliny, the taking of turtles for the tables of the great was practised in the East Indies; and if we may credit the accounts of Ælian and Diodorus Siculus, the barbarous nations of the East were accustomed to employ the shields of the largest individuals as canoes. It is believed that it is only within these hundred and twenty years that turtles have been imported into Europe for the purposes of food.

Various methods are resorted to in different countries for catching turtles. A very common mode is, to watch them as they go on shore or return during the season of laying their eggs, when they are easily arrested, and, by the united force of several persons, are turned on their backs, a position from which they find it extremely difficult to escape. Several individuals are thus turned, and when a sufficient number has been thus partly secured, they are dragged away by ropes, and carried in boats to their place of destination. This is the method practised by the inhabitants of the Bahama islands, and is often employed with success by sailors while touching at the islands between the tropics during their long voyages. Turtles are also taken while swimming in the sea. Some fishers of great dexterity dive for such as they see at the bottom in the shallows, and, getting on their backs, press down the hind part, and raise the fore part of their body, so as to compel them to rise to the surface, when an assistant is ready to slip a noose over the head, and thus secure the captured animal. The most common mode, however, of catching turtles out at sea, is by means of a kind of spear, or harpoon, with a long

wooden shaft, to which the head of the spear is but loosely attached. This kind of fishing, as it is termed, is generally carried on by two men in a small light boat or canoe. One of these persons manages the boat, while the other stands ready to dart the spear into the back of his destined victim. It is not long before a turtle is seen either swimming at the surface, or, what is more usual, feeding at the bottom, when the water is about a fathom deep. Sometimes the animal discovers the approach of his enemies, and endeavours to escape, but the men paddle after him, and generally contrive to tire him out in about half an hour's chase. The spearman then hurls his weapon, the head of which, from the peculiar construction of the instrument, generally sticks fast in the shell, while its attachment to the shaft is secured by a long string. The animal, thus wounded, again makes off, unless he has been so much fatigued in the chase as to be incapable of further exertion. In either case he soon becomes an easy prey to his pursuers.

It is only for its flesh that this species is so much esteemed, its shell being of no use. In many of the West Indian islands turtles are exposed in the open market, and a turtle-steak is there as common as a beef-steak in Britain. The flesh of the turtle is extremely nutritious, and is considered an excellent restorative in cases of debility and emaciation.

Green turtle are perhaps the most delicate, and certainly the mildest in their manners of the whole genus. They are, strictly speaking, inter-tropical animals, being rarely, if ever, found beyond the 20th degree of latitude in either hemisphere. Within their range, however, they are very plentiful, and afford an abundant supply of food to even the rudest tribes. The New Hollanders, in the northern parts of that island, which lie within the turtle latitudes, are very dexterous in the capture of them. For this purpose they make use of barbed pegs of very hard wood, which are loosely placed on the end of a pole of light wood of considerable length. This pole is made a little thick at the end, over which a loop of string is passed, the other end of which is firmly attached to the peg. This they throw as a spear, in the use of which they are extremely dexterous, and the peg, taking effect in the cartilaginous covering of the turtle, remains firm there, while the long handle disengages from the peg, but remains attached by the thread, and acts as a float which keeps the turtle close at the surface, so that they can paddle after it till it is completely exhausted, and so capture it with very little trouble. On the north-west coast of the same island, where the land is almost, or altogether barren, and no inhabitants have hitherto been seen, turtle come to the banks in great numbers for the purpose of depositing their eggs, and are captured by turning them on their backs, in the same manner as is practised at Ascension, in the South Atlantic, and at the Gallipagos islands, on the west coast of America.

It should seem that volcanic formations, and also coral reefs, have some peculiar attractions for these animals; and it is natural to suppose that they should, inasmuch as these are the elements of much greater fertility for those marine plants upon which turtle feed, in both of these, than those are in more earthy formations. Volcanic matter always contains a considerable proportion of salts or alkalis, and there is a good deal of animal matter in the substance of

the coral reef. These substances not only act as manures to the sea-weeds, but they serve to combine the earthy particles more firmly together, and thus a firmer hold is given to the vegetation. This is so remarkable, more especially on the reefs, that, after the lapse of a year or two, substantial rock, with thick vegetation upon it, may be found in places where the deep sea line could previously find no bottom.



Chelonia caretta, the hawk's-bill, or tortoiseshell turtle. The name of hawk's-bill is given to this species from the form of the jaws, which are produced, sharp at the terminations, and incurvated so as to have some slight resemblance to the bills of birds of prey, and it is called, *par excellence*, the tortoiseshell turtle, because it is from this species that the fine tortoiseshell used for so many ornamental purposes in the arts is obtained. The plates or shells of some others are occasionally used, but they are very inferior both in colour and lustre, and thus they are employed only as veneers, through which a coloured ground may be seen.

The hawk's-bill turtle, though of considerable size, is much less than the preceding, the largest individuals seldom weighing more than three or four hundred pounds. The shield is of an oval, and almost heart-shaped form, slightly sinuated before, and narrowest behind. The disk is covered with thirteen plates, that are two or three lines thick, of a smooth surface, nearly transparent, lying over each other like tiles upon a roof. The five vertebral plates are of unequal size and figure, though each is ridged longitudinally in the middle. That nearest the head is very large and quadrangular, with a semi-circular margin anteriorly. The three next plates are hexagonal, and have their greatest length across the body. The fifth is pentagonal, with one angle directed backwards, and a little prolonged towards the tail. The eight lateral plates are very large, and of an irregular pentagonal figure. There are twenty-five marginal plates, which are so much imbricated as to give the sides of the animal a serrated appearance. The colour of all these plates is generally black, with irregular transparent shades of red or yellow—all of them together sometimes weigh from four to eight pounds.

We have been thus particular in describing the plates of this species, because they constitute its most valuable product. They form what in Europe is denominated "tortoiseshell," but which, by the inhabitants of the West Indies, is more properly called "turtleshell." The head and neck of the caret turtle are considerably longer than those of the green turtle, and the upper mandible projects so much over the lower, as to give the snout a distant resemblance to the bill of a bird of prey, whence English sailors have given it the name of hawk's-bill.

This species is found in the Asiatic seas, and on

the Atlantic coasts of America, but is said not to be met with in the South Sea.

Though so much smaller than the green turtle, the hawk's-bill possesses considerable strength; and when attacked, defends itself with much ferocity, giving very severe and painful bites. It is also more difficult to secure, as its shield is more convex, and its feet longer than those of the first species; so that when turned on its back, it more readily regains its natural position. The female begins to lay her eggs in May, and continues, with intervals, till July. She is said not to deposit them in fine sand, but in gravel mixed with shells. The young of this species very nearly resembles those of the former.

The eggs of the hawk's-bill turtle are esteemed very delicious; but its flesh is unwholesome, and affects those who eat of it with fever and dysentery. It is almost entirely for the plates of tortoiseshell that it is made an object of search.

The use of tortoiseshell was known to the ancients, but it is only in modern times that the manufacture of it has been brought to perfection. In selecting the plates, those are preferred which are thick, clear, and transparent, and variegated with dark brown, golden yellow, red, and white. In preparing them for use, the plates are softened in warm water, and then reduced to the desired shape, by pressing them in warm iron moulds. After they are cooled, they are taken from the mould, smoothed and polished. For the purposes of inlaying in cabinet work, the moistened plates are pressed perfectly flat, and kept in that state till cool and dry. It is usual to place below them metallic leaves of such a colour as it is wished should appear through the transparent part of the shell.

In the Indian and Chinese seas the hawk's-bill turtle is very plentiful; and it forms one of the principal objects of the Malay fishery, which is carried on through all the eastern archipelago, and along the north-east coast of Australia. As this species is valuable only on account of its shell, it is not sought after except by nations which carry on trade; and, indeed, the capture of it requires a little more dexterity than that of the eatable turtle. It is also very abundant in many parts of the West Indian seas, more especially in the gulf of Honduras, where great numbers are captured. It is sometimes said, that the shell is inferior in the western world to what it is in the eastern; but it does not appear that there is much truth in the saying.

Chelonia Caouanna, the loggerhead turtle. This species is much more discursive than either of the two former, and also occurs in higher latitudes. Its colour is more or less of a reddish brown; five plates in the middle of the shield have an elevated crest in the centre; the point of the upper jaw is curved; and the legs are much longer and straighter than in either of the two former species. It is a powerful animal, and very energetic in all its actions.

It is a large species, and is said sometimes to exceed the green turtle in size. Its head is much larger in proportion than that of either of the former species. The mouth, and especially the upper mandible, is also of considerable size. The neck is thick, and covered with a loose wrinkled skin, thinly beset with horny scales. The shield is of an oval form, narrowest behind. It is of a yellow colour, with black spots. The legs, especially the fore legs, are proportionably longer than in many other species; and both

the fore and hind feet are furnished with two sharp claws.

The individuals of this species are most abundant in the tropical seas, especially about the West India islands; but they are also found in the Mediterranean particularly on the coasts of Sicily and Sardinia.

In its manners, this is one of the fiercest of the chelonian tribe; it defends itself with great courage and activity, both with its mouth and claws, and has been known to snap a moderate-sized walking-stick with a single stroke of its jaws. It appears to be the most predacious of all the turtles, not only feeding on shell fish of considerable size, the habitations of which it easily breaks with its strong mandibles, but attacking the young crocodiles, seizing them by the tail as they retire backwards into the water. Thus these animals instinctively perform an act of retributive justice. The older crocodiles make a prey of the eggs and young of those turtles which inhabit the shores to which they resort, and the turtles in return seize on the young crocodiles while they are too weak to defend themselves.

The loggerhead turtle wanders very far from land. It has been seen apparently sleeping on the surface of the ocean, about midway between the Azores and Bahama islands, at a distance of many hundred miles from land. The female lays her eggs in the sand.

The flesh of this species is coarse and rank, and eaten only by the lowest classes of the people. Its body, however, affords a considerable quantity of oil, which is used for burning in lamps, and dressing leather. The plates of its shell are too thin for most purposes, but have been employed in cabinet work.

Chelonia coriacea, the leather-coat tortoise. There are several varieties of this species, all inhabitants of the sea, and some of them found at least occasionally in the Mediterranean. Their shield, even on the back, is flexible and leathery, and they have no plates even on the under part. Their flesh is not eaten, neither is there any part of them used in the arts; but it is necessary to attend to them with some care, as they have been confounded with some of the fresh-water tortoises.

GENUS II. TORTOISES (*Testudo*). These admit of division into several genera or sub-genera, according to their appearance and habits; and the species are very numerous, so much so, indeed, that we shall not attempt even to give a list of them. There are at least between fifty and eighty species, about thirty-six of which live generally in the fresh water, and the remainder generally upon land; but both of them hibernate in the mud or earth.

The fresh-water tortoises have all the toes separated, and generally a crooked claw upon each, though they are generally more or less webbed, or united by loose membranes. They have five toes on the fore feet, and four on the hind; and the feet are adapted both for swimming and walking. Their principal food consists of insects, small aquatic animals and fishes, and some of them eat voraciously, though all are capable of long abstinence. Some of them have the shell more and some less consistent.

European fresh-water Tortoise (*Testudo Europæa*).—This species is very common in the south and east of Europe, and is found as far to the northward as Prussia. It grows to the length of about ten inches. Its shield is oval, not much convex, nearly smooth, of a blackish ground colour, and spotted over with yellow points

disposed in rays. Its flesh is eatable, and it is sometimes fed with bread and green leaves, but it also eats insects, common slugs, and small fishes. It is sometimes made use of for clearing gardens of molluscous pests; but it does not thrive unless the garden contains a pond of water, and if there are fish in the pond, it is very apt to lay them under contribution. Its general progressive motion is very slow, but its neck admits of rapid motion, and, indeed, the neck is the grand organ of motion in the whole order. The other fresh-water tortoises are chiefly met with in the warmer regions of the world, though they have more range in latitude than the sea turtle.

Some of them have no scaly plates either on the shield or the breast-plate, but are supported entirely by the bones. They have in general their ribs produced on the margins of their covering, so as to form a border which is partially moveable, and of considerable assistance to them when they swim, which they do in shallow waters and among aquatic plants, where it is more difficult to make way than in the haunts of the sea turtle. They are also among the most active of the order; and though they have not the strong protection of the horny shell, they are endowed with a degree of activity and courage, which much more than compensates. They are all inhabitants of the fresh waters; and, with the exception of those in the sea, they are the largest animals of the order. We shall mention only the two principal ones.

Soft Turtle of the Nile (*Testudo triunguis*). This species is found principally in that river from which it derives its common name. Its colour is green, spotted with white, and the shield on its back is a little convex. It is an active animal, preying on young crocodiles, of which it destroys great numbers. It sometimes attains the length of three feet or upwards.

Fierce Tortoise (*Testudo ferox*). This is the most formidable of all the tribe; and as it has been confounded by some writers with the coriaceous turtle, it is necessary to attend to the distinction between them. The coriaceous turtle has an oblong body, covered immediately with a bony shell; but that shell is invested with a tough membranous coat resembling leather, plaited longitudinally, and the shield terminates behind in an acute point, overhanging the tail. The body of the fierce tortoise is rounder and more convex, and the middle part of the shield is hard; but its margin, especially towards the tail, is soft and pliable, resembling thin sole leather, and the hind part is rounded. The tail of the first species is long, and very thick at the root; that of the second very short and small. The head of the former is small, round, and terminates in a beak, resembling the bill of a bird; that of the latter is proportionally larger and longer, with a long tapering cylindrical snout, having some resemblance to that of the mole. The coriaceous turtle is an inhabitant of the sea, is frequently found in the Mediterranean, and has been seen even on the coast of Britain. The fierce tortoise has yet been found only in the rivers and fresh-water lakes of America, especially in Florida and Carolina. The former is a large species, often measuring above seven feet in length; the latter seldom weighs above seventy pounds.

The fierce tortoise frequents lakes and muddy rivers, and hides itself among the water plants that

grow at the bottom, from which it is said to spring suddenly on its prey. This consists of small water animals, and in some places, more particularly of young crocodiles, of which this species is extremely fond. They seize their prey by suddenly darting forward their long and strong neck, which they do with great celerity.

This species is among the strongest and most active of its tribe, and as its trivial name implies, is possessed of ferocity and courage. When attacked, it boldly defends itself, rising on its hind legs, and leaping forward to seize on its assailant; and if once it fixes with its jaws on any part, it is scarcely made to let go its hold without cutting off its head. Though the fierce tortoise does not form so extensive an article of commerce as the green turtle; and perhaps on account of its activity, does not accumulate the soft and luscious green fat which epicures prize so much, yet its flesh is wholesome and is eaten with avidity, especially by the Indians in those parts of America where it is most abundant.

The Mud Tortoise (Testudo lutaria). The mud tortoise is the smallest of the fresh-water tortoises; its whole length, from the snout to the tip of the tail, seldom exceeding eight inches, while in breadth it is not more than three or four. It is of a blackish or dark brown colour. Its tail is nearly half the length of the shield, and is stretched out when the animal walks. Hence the mud tortoise has been sometimes called by the ancients *mus aquatilis*, or water rat.

This is a very frequent inhabitant of lakes and muddy rivers in the south of Europe, and in many parts of Asia. It is very plentiful in France, especially in the provinces of Languedoc and Provence. It lives almost entirely in the water, only going on land to lay its eggs, which it covers with mould. It moves with a quicker pace on land than many of this tribe; when disturbed it utters a kind of interrupted hissing sound. It feeds on fish, snails, and worms, and often proves a troublesome inmate in fish ponds, killing many of the fish, and biting others till they are nearly exhausted from loss of blood.

It has been proposed to employ the mud tortoise for destroying vermin in gardens; but it is necessary to have a pond or large vessel of water for its ordinary residence. With such a convenience, it may be rendered tame and domestic.

The young of this species, when first hatched, are not an inch in diameter. They continue to grow for a long time, and are known to live for many years.

There are many other species of tortoise, which inhabit the fresh water, of which we shall only mention the *Painted Tortoise (Testudo picta)*, which is an American, and a very handsome species, at least in so far as colour is concerned. It is smooth, of a brown colour, and each of the scales is surrounded by a yellow band, which is broader at the anterior edge than any where else. It is found in North America chiefly, and is more active than many of the others, often climbing rocks, and even trees, in search of insects, which constitute the principal part of its food; but the moment that it is observed, it drops into the water, and so escapes.

The land tortoises have in general the shell harder, and thicker in proportion to their size than any of the aquatic ones. In this way they follow a very general law of all animals, part of which inhabit the land, and another part the water; for even the bones

of aquatic animals contain a much smaller portion of salts of lime than those of the most nearly allied species which dwell upon land.

The land tortoises have the shield on the back supported by a frame-work of bones, which is united into one solid structure, so as to admit of little or no motion in the several parts; and the sides of it are in great part firmly soldered to those of the breast-plate, the whole forming a complete sheath of immense strength. The legs are very short, and so are the toes, which have five on the fore-feet and four on the hind. The nails or claws are strong and conical, and well adapted for digging; but their motion is exceedingly slow. They can, however, move under the load of a much greater weight, in proportion to their size, than any other known animals. They are capable of living for a long time without food; and, indeed, they are the very models of animal endurance. They are inoffensive in their manners, and seldom or never attack any animal, except those insects, mollusca, and worms on which they feed, and many of them eat green vegetable matter. The greater number of them, and perhaps the whole, spend part of the year in a state of hybernation, and bury themselves in the earth for this purpose. They do not construct a burrow with an entrance, as is done by the burrowing mammalia, but fairly sink down the body, throwing the earth on the back as they descend. This process is performed very slowly, but the progress of it is abundantly sure. In the course of their digging the head and tail are drawn within the shell, for all of them have the capacity of bringing both these and the feet within that covering. Their ascent to the surface is rather a more curious matter, and one which cannot be so well observed, but it may be presumed to be performed by bringing the earth gradually under the feet, and forcing upwards the strong and convex shield, with that powerful action which enables them to bear so great a weight. Some of them have the power of enclosing all the moveable parts of the body entirely within the shell, by drawing firmly moveable pieces of the anterior and posterior parts of the breast-plate against the corresponding portions of the shield. Those which can do this are called *box tortoises*; and they shut their box with as much firmness as the whole race are capable of shutting their jaws. There are a good many species, but we must restrict our notice to one or two.

The Common Land Tortoise (Testudo Græca). This species seldom attains a foot in length. It is of an oval form, with a very convex shield, broader behind than before. The breast-plate is nearly of equal size with the shield, and is of a pale yellow colour, with a broad dark stripe down each side, while the middle part of the shield is of a blackish brown mixed with yellow. The head is small, and covered on its upper part with irregular scales; the mouth is small, the legs short, and the feet pretty broad, and covered with strong ovate scales. The tail is very short, scaly, and terminated at its extremity with a curved horny process. It seldom weighs above three pounds.

This species is entirely confined to the land, and prefers elevated woody situations. It is found in Europe, Asia, and Africa, and is very common on all the coasts of the Mediterranean sea, especially in Sardinia, Barbary, and probably in Egypt. It is not a little curious that, even in the warmer climates, this species regularly retires to its subterranean quarters during the winter months; thus proving, what we

have before remarked, that the hybernation of these animals does not depend solely on the degree of cold. It begins to bury itself in October, and usually makes a hole about two feet below the surface, where it continues till April.

The males of this species are in summer tolerably active, and very fierce towards each other. The female lays her eggs towards the end of June, depositing them in a hole, and covering them with sand or mould. They seldom exceed five in number at one time, and are of a white colour, and about the size of those of a pigeon. They are hatched towards the end of September, and the young, when first extruded, are scarcely bigger than walnut shells.

The individuals of this species live on roots, fruits, worms, and insects, the shells of which latter they easily break with their strong jaws.

It has sometimes been alleged that land tortoises do not drink; but this is not correct: they are, no doubt, abstemious in their drinking, as well as in their eating, but it is well authenticated that they drink water, and that they are even partial to milk. They are very long-lived creatures; and some of them, even when removed to a colder latitude than that of which they are natives, have remained healthy for upwards of a century. Their flesh is eatable, and forms an article of human food in Greece; and the Italians eat the eggs, though not the animals themselves, at least not generally. Several varieties of this species are described by systematic writers; but they differ little from each other, except in the markings of the shell.

The Indian tortoise is a large species, of which individuals have lived, at least for some time, in Britain. One species, presented to the Zoological Society of London, in 1833, measured along the curve of the back four feet four and a half inches; the length of its sternum two feet eight; the breadth of the same two feet one; its total weight two hundred and eighty-five pounds. This individual had lived seventy-seven years at Port Louis in the Island of Mauritius. A large specimen from Bengal, which had died at the gardens of the Society some time previously, enabled a more careful examination to be made of its anatomical structure; but the details of these are not exactly adapted for a popular work.

The Geometrical Tortoise (*Testudo geometrica*). This is a very beautiful small species. The shell is black, and the plates, though of considerable thickness, are flattened into regular discs, which are beautifully marked with yellow rays, proceeding regularly from centres.

CHELOSTOMA (Latreille). A genus of hymenopterous insects, belonging to the section comprising the bees, *Mellifera*, family *Apidae*, and sub-family *Dasygastres*, of Latreille, having the body very long, narrow, and nearly cylindric, with the mandibles advanced, narrowed, curved and notched at the tip; the labial palpi are composed of a single joint, and the maxillary palpi are three-jointed; the marginal cell of the upper wings is not narrow at its extremity, and the second abdominal segment of the males is furnished beneath with a curious horny tubercle, answering to which is a singular cavity, covered with satiny down near the anus; like the division to which it belongs, the belly is amply furnished with a coat of down in the females, which serves for carrying the pollen gathered by the insect, destined for the support of her progeny. These insects, when asleep,

roll themselves up somewhat like the wood-lice, the ventral horn fitting into the anal cavity above mentioned; they usually take their luxurious repose in the middle of a flower, whence the type of the genus has obtained the specific name of *Apis florissomnis*. An interesting account of the habits of this insect is given in the Entomological Magazine by Mr. Doubleday, of which the following condensed statement will not prove uninteresting to our readers. Although the male is a perfect sybarite, a mere voluptuary, the female is the very model of maternal industry, her whole life being spent in providing for her family. Here we may observe, that in this, as in numerous other wild bees, there are no neuters, upon which depend the whole labour of the community; indeed here no community exists, each bee is solitary, and each female has to undergo the task of forming and provisioning its own nest with a sufficient supply of food for its young when hatched, which does not take place until the life of the parent has ceased, so that the young are deprived of that constant attendance, which the hive bees bestow on their progeny. The female chelostoma carefully selects a spot in the posts of trellice, or other out-door wood-work, preferring the sunny side of those parts which are quite dry and going a little to decay; she there pierces a hole nearly horizontally, about an inch in depth, then changing the direction, she proceeds perpendicularly, her powerful jaws being the only tools wherewith she gnaws her passage through the wood, kicking the saw-dust out of the hole, passing it from one pair of feet to the next. This burrow is nearly a foot long, and in it, when completed, she commences the construction of about twenty cells, which are to be filled with pollen paste, and in each of which a single egg is to be placed. As however in the construction of these cells, and the deposition of an egg in each, the bee must work upwards, it is evident that the lowest egg will be deposited first, and will consequently first arrive at the perfect state; and unless provision were made for this circumstance, the first-born bee would either be compelled to remain a prisoner, in its cell until its *upper* brethren had taken their departure, or it must make its way through the cells placed above it, which could not be done without detriment to the inhabitants. Now the bee, exhibiting as striking an instance of that principle which we call instinct, as is to be found in any animal whatever, pursues a plan, not indeed by the operation of any thinking foresight, and still less being the result of education, which amply provides against this emergency, by again changing the direction of her burrow, at the bottom of the perpendicular part, so as to emerge again out of the paling. She then closes the hole just above the lower bend by a partition of fine sand, firmly glued together by means of a viscid saliva, with which she is copiously furnished; then laying at the foot of the enclosed part a sufficient quantity of pollen mixed with honey from the nectaries of flowers, for the support of one larva, in the midst of which she places a single egg, and closes the cell in the same manner as she found its bottom. In this manner she proceeds till she has reached the top of the perpendicular part. The two orifices of the burrow are then closed up, the lower one with a mixture similar to that employed in the division of the cells, offering of course but little resistance to the force of the bees when arrived at the perfect state. The upper one, however, being more exposed to danger from rain

which might enter, and getting into the nest, destroy the young larvæ, is first closed in the same manner as the bottom one, to which is added a layer of much larger grains of sand, glued together in a similar manner, each being fixed in the most convenient place by the assistance of the mandibles. Notwithstanding all her care, however, various parasitic insects contrive to deposit their own eggs in the cells in the absence of the parent bee, the progeny of which, of course destroys that of their fosterer, amongst which the *Chrysis cyanea*, the *Ichneumon manifestator*, and the *Fænus jaculator*, have been observed by various authors. The insect whose proceedings we have here described, varies in length from one-third to half an inch. It is not uncommon, and is of a black colour, with ashy hairs; the female, which is the *Apis maxillosa* of Linnæus, has the segments of the abdomen margined with white.

CHENOLOBIA (Leach). A genus united to that of *Coronula*.

CHENOPODEÆ—Goosefoot family. A natural order of dicotyledonous plants, containing nearly thirty genera, and upwards of two hundred species. It is so closely allied to *Amarantaceæ* that, although the orders are quite different in general habit and appearance, still, it is not easy to get any constant distinguishing characters. Professor Lindley justly declares, that though he is unable to give any good artificial distinctions, he at the same time cannot hesitate to keep asunder orders which nature has obviously divided. This order, which was denominated by Jussieu *Atriplices*, has also an affinity to *Phytolacææ*, from which it is separated by the stamens never exceeding the segments of the calyx, and being opposite to them.

The essential characters of the order are: perianth monophyllous, deeply divided, sometimes tubular at the base, persistent, with an imbricated æstivation; stamens inserted into the bottom of the perianth, and opposite to its segments, equal to them in number or fewer; ovary single, free, rarely cohering to the tube of the perianth; one ovule fixed to the bottom of the cavity of the ovary; style two to four cleft, rarely simple; stigmas undivided; fruit membranous, sometimes berried; embryo curved round a mealy albumen, or spiral, or doubled together, without albumen; radicle next the hilum.

The plants belonging to the order are herbs or low shrubs, with alternate, sometimes opposite, leaves, without stipules, and small, occasionally polygamous flowers. They are generally distributed over the globe, more particularly in extra-tropical temperate regions, and are found abundantly in the northern parts of Europe and Asia.

In general they are weeds which are not remarkable for their beauty, and are not esteemed as ornamental plants; several of them are avoided on account of the disagreeable odour which they emit. Nevertheless, many of the species are highly useful to man, some being cultivated as pot-herbs and articles of food, others being used medicinally on account of their tonic properties, and others again being valuable in a commercial point of view, on account of the alkaline substance which they furnish. They are propagated by cuttings, divisions and seeds. Some of the chief genera of the order are, *Chenopodium*, *Atriplex*, *Basella*, *Beta*, *Salsola*, *Salicornia*, *Blitum*, *Spinacea*, and *Camphorosma*.

The genus *Chenopodium*, goosefoot, whence the

name of the order is derived, furnishes nearly sixty species, thirteen of which are natives of Britain. They are succulent weeds, the leaves of which are usually covered with powdery granules. *Chenopodium Bonus Henricus*, good King Henry, wild spinach, mercury goosefoot, grows abundantly in waste places and by way sides all over Britain. It is a hardy plant, of early growth, flowering in August, and is cultivated in some parts of England, more particularly in Lincolnshire, instead of spinach. The young shoots, after being peeled and boiled, are eaten as asparagus, and possess laxative qualities. The leaves are sometimes applied to wounds, and are used for cleansing old ulcers. *Chenopodium album*, white goosefoot, is perhaps the most common British species of the genus. The whole plant is covered with a white, mealy, unctuous substances which, by age, becomes dry and chaffy. In a young state, it is sometimes boiled in place of greens, and is known by the name of *fat hen* in some parts of Norfolk. *Chenopodium rubrum*, red goosefoot, is another British species, which is found in waste ground, and often in low muddy situations. A considerable quantity of saline matter exists in the juice of this plant, which sometimes crystallizes on the surface of the stem. In exposed situations, the whole plant assumes a red colour. The plant is said to be poisonous to swine. *Chenopodium maritimum*, annual sea-side goosefoot, has been used as a pot-herb, and is burned in order to yield carbonate of soda. *Chenopodium olidum*, or *valvaria*, stinking goosefoot, is found in waste places, and under walls, especially near the sea in many parts of Britain. The whole plant exhales ammonia, or hartshorn, and when recent it has a nauseous taste and a strong offensive smell, resembling putrid salt fish. The odour remains long on the hands after the plant has been touched, in consequence of the greasy pulverulent substance found on the leaves adhering to them. The medical properties of this plant are to be attributed to its fetor. It was formerly used as a powerful antispasmodic, more especially in hysterical affections. It loses its properties by drying, and consequently must always be employed in a recent state. The presence of ammonia, a compound of hydrogen and nitrogen, in this and a few other individuals of the vegetable kingdom, is a circumstance well deserving of attention. *Chenopodium botrys*, or Jerusalem oak, a native of the south of Europe, is filled with a resinous viscous juice, which stains the hands. The leaves when bruised emit a strong odour, and were formerly prescribed in the form of a decoction in some pectoral complaints, such as asthma and catarrh. This species, as well as *Chenopodium ambrosioides*, yield an essential oil, possessing stimulant, tonic, and antispasmodic qualities. The latter species, which is a native of Mexico, has sometimes been called the Mexican tea plant, in consequence of an infusion of it having been formerly used in place of the Chinese beverage. A decoction of the plant has been recommended in palsy. *Chenopodium quinoa*, a native of Chili, is very generally cultivated in Peru, its leaves being eaten as spinach or sorrel, and its seeds as rice. It is also used in the preparation of a kind of beer. Dombey, on his return from Peru, endeavoured to introduce the plant as a culinary vegetable into France, but his attempts were not followed with success. *Chenopodium anthelminticum* yields an essential oil, known in North America by the name of worm-seed oil, which possesses

powerful anthelmintic properties. Similar qualities are attributed to the seeds of this plant.

Of the genus *Atriplex*, or *Orache*, there are upwards of forty species, seven of which are natives of Britain. *Atriplex hortensis*, garden orache or mountain spinaeh, is a native of Tartary, and has been used as a pot-herb. There are several varieties of the plant, more or less tinged with red and purple. The seeds are emetic, and also cause painful diarrhœa. *Atriplex halimus* grows on the sea coast in the south of Europe, and in this country, its silver coloured foliage adds to the beauty of our shrubberies.

Spinacia oleracea furnishes the true garden spinaeh. There are numerous sorts of spinach, which vary in the shape and size of the leaves, and the greater or less pinkiness of the seeds. The broadest and thickest-leaved varieties are the most esteemed. The seeds are sown in spring and autumn, and grow readily in any kind of soil. The prickly sort are the best for winter crops, and the round for summer. *Basella rubra* and *cordifolia* are two species of Malabar night-shade which are found in the East Indies, Amboyna, and Japan. They bear spinous berries of a very dark red colour, which are used for staining calicoes in India. The leaves are eaten as spinach by the Chinese, and the plants are sometimes cultivated as culinary vegetables in the neighbourhood of Paris.

Beta vulgaris yields the culinary root, well known by the name of garden beet, which is so extensively used as a salad or pickle, and from which sugar is sometimes prepared on a large scale. There are several varieties of the plant in cultivation; but the two chief are the red or purple, and the white with red bands. Those most esteemed for salad are the small red and *castelnaudary*, while the green-topped are the best adapted for yielding sugar. The larger and deeper coloured the roots are the better. The seeds of the beet are sown in March or April, in deep, well-comminuted soil, and when two or three proper leaves appear, they are thinned in such a way as to allow a square foot of surface for each. By the months of September or October the roots are fit for use, and they are then taken up and preserved in sand. Beet-root, when taken in large quantity, acts as a laxative, but sometimes it proves injurious to the stomach. The juice of the root and leaves causes sneezing. Sugar has been obtained in very large quantities from the beet-root. The plant was formerly extensively cultivated in Germany and France for this purpose, and it is still reared in considerable quantities. During the late wars, when the sugar from the British colonies was not allowed to be exported to France, the beet-root was the only source from which sugar could be procured, and consequently its cultivation became an object of national interest and importance. The usual way in which the sugar is obtained is as follows:—The roots, after being washed and cleaned, are sliced and grated down, and afterwards bruised in successive portions of water, until all the saccharine matter is dissolved. The fluid is then filtered and evaporated, and ultimately purified and crystallised. Besides sugar, the roots contain water, fibrous matter, mucilage, starch, and colouring matter. In general they yield from two to five per cent., of sugar. M. Achard computed that a German square mile, which is equal to sixteen English square miles, would produce beet sufficient to furnish sugar to the whole Prussian dominions.

Sugar, however, cannot be advantageously obtained from this source, inasmuch, as the expense attending its preparation is too great when compared with the quantity produced. A considerable quantity of beet sugar is, nevertheless, annually prepared in France. Beet-roots, when deprived of their juice by pressure and afterwards dried, may be used in place of malt in brewing. The beer made from them is said to be pleasant and wholesome. The leaves of the beet, when reared in a rich, well manured soil, yield a considerable quantity of nitre or saltpetre.

Beta cicla, a name corrupted from *Sicula*, meaning Sicilian beet, produces a root, not by any means so large as that of the common beet. The leaves serve as a substitute for spinaeh, and the young shoots and mid rib of the leaves are eaten like asparagus. The plant grows in great quantity in the south of Germany and in Switzerland. A large variety has been introduced from abroad, under the name of *mangel wurzel*. This variety, on account of the large size of the roots, is now extensively cultivated in this country. It is much used for feeding cattle during the winter. In cultivating this variety, more room is required than in the case of the common beet, on account of the size of the root and leaves. The roots are sometimes applied externally as a poultice to ulcers. The only British species is *Beta maritima*, a sea beet which, when boiled, is esteemed a wholesome article of food.

Most of the species of *Salicornia*, another genus of this order, abound on the shores of the Mediterranean, and two of them are natives of Britain. *Salicornia herbacea*, the most common British species, is gathered when in flower, and pickled in salt and vinegar like samphire. The whole plant has a saltish taste, and is eagerly eaten by cattle. *Salsola kali*, or prickly salt-wort, is common on the sandy sea coasts of Britain, and has also been used as a pickle. *Salsola fruticosa*, found on the shores of the southern counties of England, deserves a place in gardens as being a hardy evergreen. The *Salicornias*, *Salsolas*, various species of *Atriplex* and *Anabasis*, as well as the *Chenopodiums* found in salt marshes, as well as several other plants belonging to the same natural family, growing in the south of Europe and north of Africa, yield, when burnt, a vast quantity of the substance called *barilla*, an impure carbonate of soda, which is used in making glass and soap. The English name of *glasswort*, applied to *Salicornia*, is derived from this circumstance. *Salsola soda* is cultivated extensively in Languedoc and Spain, for the preparation of barilla, which is usually exported to Italy and Sicily, but it is looked upon as inferior to the *Salsola saliva* which grows on the Spanish shores of the Mediterranean. The latter species supplies the Alicante or Spanish barilla, which is the best that is consumed in Europe.

The production of soda depends solely on the proximity of the plants to the sea, for it is from this great saline reservoir that the alkaline matter is derived. The same plants, when cultivated in the interior and far from the shore, yield totally different products.

The maritime plants employed in the preparation of soda, differ in different countries, and the quantity of alkali obtained is very various. Thus, while some kinds of barilla yield from twenty-five to thirty per cent. of alkali, others only yield twelve or fifteen; and the coarser substance called *kelp*, obtained

from sea weeds, yields only two or three per cent.

The preparation of barilla is carried on to a great extent on the shores of the Mediterranean, and there the seeds of various maritime *Chenopodeæ*, are regularly sown in places near the sea. In the month of September, when the plants have attained sufficient maturity, they are pulled up by the roots and exposed to dry, so that the seeds may be collected; they are then gathered into heaps, and afterwards burned in holes made in the ground, or in ovens constructed for the purpose; the ashes are constantly stirred, while hot, with long poles, and a hard mass ultimately remains, which, when broken into pieces, constitutes the barilla of commerce. The best sort of Spanish barilla has a dark bluish colour, is very heavy and dry, has no offensive smell, and is covered externally with numerous small depressions. That which is mixed with small stones, and gives out a disagreeable smell in solution, and is deliquescent, ought to be rejected as bad. From barilla, carbonate of soda is easily obtained by lixiviation in boiling water, and subsequent evaporation.

Carbonate of soda is of great use in the arts and manufactures, more especially in the formation of glass, and in the preparation of various kinds of soap. Glass is formed by mixing soda or potass with sand in certain proportions, and exposing the mixture to a strong heat, until the materials are fused; It is then moulded into different forms under the name of flint, crown, plate, and bottle glass. Bottle glass is the coarsest kind, and is made from river sand, which contains iron and other impurities, and the common impure alkali. Crown glass, for windows, requires fine sand, free from iron, and a pure alkali; white plate glass, for mirrors, is made from the purest materials. To the glass commonly called flint glass, some oxide of lead and manganese is added. Soap is prepared by mixing different kinds of oil, in a greater or less degree of purity, with carbonate of potass or soda; the former alkali being employed in the preparation of soft, and the latter in the formation of hard soap. The soap ordered in medicine for internal use, is formed from the finest olive oil and pure carbonate of soda.

The purest barilla, though well fitted for ordinary manufactures, does not serve for chemical purposes, on account of the mixture of the sulphates and muriates of potass and soda. A carbonate of soda, considerably purer, is easily got by exposing sulphate of soda, or Glauber's salt, with saw-dust and lime, to the action of a reverberatory furnace, and afterwards lixiviating and crystallising.

Blitum is another genus of this order, furnishing several species, one of which *Blitum capitatum*, berry-headed strawberry blite, is a native of Austria. In this species, after the flowers are faded, the heads swell to the size of wood-strawberries, and when ripe, have the same colour and appearance. They are succulent and stain the hands, and were formerly used by cooks for colouring puddings. Another genus *Camphorosma*, receives its name from emitting a smell of camphor.

From the above account of the *Chenopodeæ*, it will be seen that the plants of this order, although they contribute little to the ornament of our gardens, are still of considerable importance and interest, when we consider the useful purposes to which they are applied. Many of them are among the most common weeds of

the countries in which they grow, and yet, when properly used, they contribute, in no small degree, to the comforts, and even the luxuries of life.

CHENOPODIUM (Linnæus), vide GOOSEFOOT.

CHERIMOYER is the *Anona cherimolia* of Mikan, an excellent South American fruit tree. A majority of the anonas yield useful and pleasant fruit, but the cherimoyer is the best of all.

CHERMES (Linnæus). Under this generic name were designated, in the Linnæan system of Entomology, numerous minute insects, allied to the aphides, from which they are distinguished by the antennæ having ten or eleven joints, and by their powers of leaping. These insects, of which there are various species, have been termed by the French Entomologists false aphides. They subsist upon plants. Geoffroy, however, considering that the term chermes had been improperly applied by Linnæus, gave to these insects the name of *Psylla*, derived from the Greek, and having reference to their saltatorial powers, whilst he employed the name of chermes, in its more legitimate sense, to denominate some of the Linnæan species of *Coccus*, which had been used as dyes; the names *Chermes*, *Kermes*, or *Alkermes*, having been given by the Arabians and Persians to the *Coccus ilicis* of Linnæus, which is found abundantly upon the small evergreen oak, *Quercus coccifera*, growing in the south of France and other parts of the world, and which has been employed to impart a blood red or crimson dye to cloth from the earliest ages, having been known to the Phœnicians before the time of Moses, under the name of *Tola* or *Thola*, and to the Greeks under that of *Coccus*. It was with this that the Greeks and Romans produced their crimson, and from the same source the unfading reds of the tapestry of the Low Countries were derived. With a solution of alum it produces a blood red, but when mixed with the solution of tin, as brilliant a scarlet is obtained as that derived from cochineal. As, however, ten or twelve pounds of chermes contain only as much colouring matter as one of cochineal, the latter, at its ordinary price, is cheapest. Introduction to Entomology, vol. i. page 321.

As Entomologists, in general, have adopted Geoffroy's name of *Psylla* for the insects first above mentioned, and as the majority of them have not thought it necessary to divide the Linnæan genus *Coccus*, as Geoffroy has done, we shall defer any further observations upon the *Chermes* of the latter author, until our articles upon *Coccus* and *Cochineal*.

CHERRY. The cherry is one of our most common, as well as most beautiful garden and orchard fruits. Like other wild genera, it has been wonderfully improved by art, and many excellent varieties have been obtained by the art of manual impregnation, and not a few by accident. In its wild state the cherry is a lofty tree, producing valuable timber, useful to the cabinet-maker, turner, and other workers in wood. The timber is also durable; a gate-post made of the heart of a cherry-tree, lasts as long as one made of the heart of oak. All the improved varieties of this tree cultivated in gardens, are more or less dwarfed, and changed in their manner of growth, as well as in the manner of bearing their fruit.

A deep sandy loam appears to be the most genial soil for the cherry; and some of the sorts, as the Kentish, for instance, grows and bears well in what may be called pure sand.

The improved varieties cannot be raised from their seed; for though these varieties were at first originated from accidental or artificial impregnation, yet the effect of the strange pollen appears to be confined to the progeny following immediately after impregnation, because the seeds of the next generation, that is, seedlings from the improved variety, retain no feature of the improvement, but go back to their original wild character. It seems therefore, in this, as in other cases of the same kind, that the mixture or influence of strange pollen, effects a change in the habit generally, in the enlargement of the leaves and pulpy covering of the stone, and in the organisation of the kernel belonging to the flower impregnated, but that this influence on the kernel is not permanent, and ceases after the first year.

But although these improvements cannot be perpetuated by seeds, they are readily and purely continued by the common practices of grafting or budding on their own stocks, or rather upon stocks raised from the stones of wild cherries.

Cherry trees do not all bear flowers and fruit in the same manner; the morella bears on the last year's young shoots; and the may-duke and most of the others bear on shoots, also produced in the past year, but from the older wood, and so short that they are called spurs. This difference in the manner of bearing indicates the manner in which the trees should be pruned and trained. The morella for instance, is pruned and trained like the peach tree, because they both bear fruit in the same manner, namely, on the young shoots of the previous year. The other sorts, as the may-duke, when planted against walls, or as espaliers, are trained in the fan manner, or horizontally, or in any other way, that the strength or vigour of the tree may indicate. A weakly growing tree should be trained erect, that is, have its branches laid in as nearly upright as possible; while a strong grower should be laid horizontally, or drooping, in order to cause fruitfulness. As low standards in gardens, or high standards in orchards, cherry trees of all sorts generally do well if the soil be suitable. Such trees seldom want pruning, except to cut out dead wood, or over-crowded branches which press on each other. Old worn out standards are often profitably renovated, by having their largest branches cut back.

In orchards attached to farm homesteads, we often see cherry trees in great perfection, and yielding a considerable revenue to the owner. The cherry orchards of Kent, and other counties near the metropolis, are famous for the income derived from them. The farmers manage their trees well; and one part of their practice deserves imitation. They plant strong healthy stocks in the place where the tree is intended to stand; and when these are well established, graft or bud them with the desired sort. This is a good practice, and suitable for all other orchard fruit trees, as well as cherries. Grafting is preferable for sooner obtaining a spreading head, and for rendering it less liable to be blown off by the wind. Budding, however, is not so likely to gum at the place of insertion; and ultimately forms a perfect union with the stock, if care be taken to give the first shoot or shoots the necessary support during the second and third year after working.

Cherries are much preyed on by birds, and to preserve them requires no little care. In cherry orchards a keeper must be constantly, early and late, on the

alert, to frighten away the thieves. In gardens, nets are the best defence; but they can only be used conveniently against walls, or over espaliers or low standards. The tree is liable to suffer from the attack of insects. The aphids often settle in great numbers on the points of the shoots, and not only prevent a healthy growth, but disfigure the fruit by the honey-dew which these insects emit. A fumigation with tobacco smoke a fortnight or three weeks before the fruit ripens, will kill or drive away the insects. For this purpose a thin canvas cloth of sufficient size to cover a tree, in the open air, is requisite; but it is better to prevent the insects settling by repeated and forcible watering, than have to drive them by any such nauseous application as either tobacco or brimstone.

The delicate blossoms of the cherry, and all other early-flowering fruit trees, are liable to be withered and destroyed by dry winds and hot sunshine, as much as they are by frost. This is the reason that if they chance to blow in cloudy weather, or during a wet time, more abundant crops follow, than when the blooming takes place under bright sunshine. For this reason also, it is, that morella and other sorts, as well as some kinds of plums, are more prolific on a north than on a south wall or aspect, merely because the tender pistil and stamens of the flowers are scorched before they have performed their respective functions. This shows that shading by day is quite as necessary as covering from the frosts of night. This fruit tree is also subject to be enfeebled and barren, from its over-abundant flowering; a circumstance which, if it happens when the weather is favourable for the flowers, a great load of small worthless fruit is the consequence; and if the weather be hot and bright, every flower will be withered, because of weakness caused by their superabundance. In this case thinning the buds or flowers before they blow, or rather as soon as they burst from the bud, will prevent exhaustion of the tree, invigorate the reserved flowers, and ensure a regular crop.

The may-duke forces well; but they require a house built on purpose. Dwarf plants three or four years from the bud, and standards of the same age, should be planted to fill the house from front to back. Gentle forcing, very gradually increased, with a constantly moist atmosphere within the house, are the circumstances indispensable for cherries forced to yield their beautiful fruit in March and April.

There are many varieties of the cherry now in cultivation, of which for gardens the following are particularly suitable, viz. may-duke, graffion, blackheart, whiteheart, biggaroon, Kensington duke, Knight's blackheart, and morella. For farm orchards the Kentish and caroon are the most certain bearers; the last growing to a fine stately tree.

CHERSYDRUS. A genus of true serpents found in Java, and the other isles of the Sunda group. Some writers have confounded it with *Acrochordus*, which is not a poisonous serpent, and has the scales with small crests, and interspersed with warty tubercles. This species, on the other hand, has the scales all over the head and body small and flat, and ensiform in appearance. This genus inhabits the bottoms of rivers in the countries above named, and is described as being very venomous. The chief difference between it and the other water serpents which are poisonous, consists in the smallness of the scales on its head. It

has not been positively ascertained whether this species is ovoviviparous, that is, whether it hatches its eggs internally, and brings forth the young alive; but the analogy renders this probable, as that is the case with all the venomous serpents of whose mode of production we have any knowledge. The habits of the aquatic ones are not, however, so easily studied as those of the land, and even they are but little known.

CHERVIL is the *Chærophylum sativum* of botanists. It is a native of Britain, and cultivated as a salad or pot-herb. It being an annual, the seeds are sown in the spring, and at several different times afterwards, where a supply of the tender leaves are required. It belongs to the natural order *Umbelliferae*.

CHESTNUT is the *Castanea vesca* of Thouars, and the *Fagus castanea* of Linnæus. There are four species, and several varieties of this fine useful genus in cultivation. As a timber tree it is only equalled by the oak; it being equally picturesque in habit, and as durable when converted to the purposes of the builder. For coppice wood it is unrivalled, yielding as quick a return as any other kind of tree whatever.

It is to be regretted that our early planters—that is, all those who were prompted by the immortal Evelyn to improve and adorn their estates and country seats by planting forest trees, did unaccountably neglect the sweet chestnut. It could not be from ignorance of the value of the timber, because it had always been previously used in the construction of the roofs of public buildings; nor could it be from fear that the trees would not succeed in these kingdoms; as, if not the largest, certainly the oldest tree in England was a chestnut, then and we believe now growing in Gloucestershire, a tree which was called “the great chestnut” in the reign of King John. Nor was the propagation difficult. Seeds in any quantity could have been had from Spain and other parts of the continent at any time; and no seeds rise more readily, or grow away more vigorously, than chestnuts, provided mice, squirrels, and jays, can be kept from devouring them while in the seed-bed. Sowed in a bed of any light soil in the month of March, not too closely together, and covered with about an inch and a half, or two inches of soil, they soon make their appearance, and where they may stand till large enough to be transplanted into nursery rows in an open quarter.

The sweet chestnut requires a kind of training in the nursery, much more than other forest trees do. They rarely rise with a single stem; but beside the principal stem, which is always the most central, four or five others rise from the collet, and were they suffered to remain, would disfigure the tree, if intended to grow as a forest, or for open grove planting. These supernumerary stems are, therefore, pruned close off when first transplanted from the seed-bed; and, while standing in nursery rows, all such side shoots from the lower part of the stem, must be pruned off.

This character and manner of growth of the chestnut seedlings, and which requires the attention of the nurseryman to correct in the first stages of their growth when intended for timber, is the very property for which this tree is so suitable for underwood. Here the greater number of stems which rise at once from the root, not only increase the value of the produce; but improve the form of the poles, by inducing a more upright and straight growth.

From the circumstance of many of the principal timbers in the roofs of our cathedrals being found to be chestnut, it has been surmised by several writers, that this tree was once plentiful and of great size in this country. The only argument against the probability of this idea is, the present scarcity of this tree in our parks and natural forests; for, if they were at any former period natives, why should this kind of tree have so suddenly disappeared. The greater probability is, that when a cathedral was about to be built, all Christendom was called on to assist, especially when the Pope could issue imperative commands on such occasions. And it is most likely, that the beams and rafters of Westminster and other cathedrals, were from the forests of Spain and Italy.

As a fruit tree, the chestnut is of little value in England, it being only in very favourable seasons that the nuts come to perfection. As an ornamental and timber tree, however, it deserves the first notice of the planter; and as it has been pretty extensively planted within these last four-score years, another generation, perhaps, may see chestnut timber as plentiful as the best oak is at the present time.

Sweet chestnut underwood, judiciously planted on light loamy soil, and carefully managed, proves a profitable possession; the produce being usually fit to cut every eight or ten years, and sells at high prices. Hop growers prefer chestnut poles, as well for their regular form as durability; and the stools yield great numbers of stakes and headers for fencing.

CHICK PEA is the *Cicer arietinum* of Tournefort. This plant is cultivated in the south of Europe, where it is indigenous, and is an article of diet among the poor, but is chiefly used for feeding poultry.

CHIGOE, or, as the English residents in the West Indies have corrupted the name, *Jigger*. A species of insect belonging to the family of fleas, *Pulicidæ*, but considered by Latreille as probably forming a distinct genus. The names *Nigua*, *Tungua*, and *Pique*, have also been applied to this insect, but Latreille has considered that the first and third belong to the *Acarus Americanus*, whilst he gives the *Chigoe* as another species of *Acarus*. Mr. Mac Leay, however, who, from his residence at the Havannah, must be considered a more competent authority, states that the Spanish name for the troublesome *Pulex penetrans* is *Nigua*, and the British West India name *Chigoe* or *Jigger*. The habits of this insect are very different from those of the common flea. According to Stedman it gets in between the skin and the flesh without being felt, generally under the nails of the toes, where, while it feeds, it keeps growing till it (or rather its habitation) becomes of the size of a pea, causing no further pain than a disagreeable itching. It will, however, attack any exposed part of the body; indeed an instance has been recorded where it got into the hand. In process of time its operation appears in the form of a small bladder, in which are deposited thousands of eggs or nits, and which, if it breaks, produce so many young chigoes, which in the course of time create running ulcers, often of very dangerous consequence to the patient, so that at times the soles of the feet are even obliged to be cut away before the patient can recover, and some men have lost their limbs by amputation, nay, even their lives, by having neglected to eradicate these abominable vermin. The moment, therefore, that a redness and itching more than usual are perceived, it is time to extract the chigoe which produces them. This is done with a sharp point

needle, taking care not to occasion unnecessary pain, and to prevent the chigoe from breaking in the wound. The female slaves are often employed to extract these pests, which they do with uncommon dexterity. Tobacco ashes are put into the orifice, by which in a short time the wound is healed. Here, however, as in the attacks of most other tormenting insects, we find that cleanliness is the best preservative, persons who take care to wash their feet often, being but little subject to annoyance. It is likewise found that rubbing the feet over with bruised tobacco leaves is a preventive against them. Great uncertainty prevailed as to the real nature of this insect until Swartz investigated its history, and published a short paper upon it in the Stockholm Transactions, proving that it belongs to the flea family. He has, however, represented it with a long porrected proboscis.

CHILOCHLOA (Beauvois). This is a genus of grasses, formerly known and included under the genus *Phleum*. They are mostly annuals, and of no value as agricultural plants.

CHILOGLOTTIS (R. Brown). A curious tuberous rooted orchideous plant from New Holland, introduced into our collections about 1823. This is a pretty hardy plant, and is usually kept in a frame, planted in turfy moor-earth, or "in the open border if care be taken to defend it from frost."—*Sweet*.

CHILOGNATHA (Latreille, MacLeay). An order of wingless insects, corresponding with the apterous genus *Iulus* of Linnæus, and distinguished by having the body long, crustaceous, and often cylindric, and the antennæ seven jointed, and forming, in the system of Latreille, one of the two families of which the order *Myriapoda* is composed, the other being formed of the *Centipedes*, *Chilopoda*, or the Linnæan genus *Scolopendra*. These two groups have many characters in common; they are equally possessed of a very great number of legs; the abdominal are not distinguished from the thoracic segments, as they are in true insects. The body, destitute of wings, is composed of an extensive series of segments, of equal size, and bearing, with the exception of the anterior, two pairs of legs, as noticed in our article on the *Centipedes*. The *Myriapoda* somewhat resemble small serpents or nereides, having the legs fixed close together throughout the whole length of the body. The antennæ are two in number; the eyes are composed of an union of ocelli, and if, in some species, these organs offer a faceted cornea, each of the lenses is much larger and more distinct than in the true reticulated eyes of insects; the number of the legs, as well as of the segments of the body, increases with the age of the animal. These animals live, and continue to increase in size for a much greater period of time than insects; and, according to M. Savi, two years are required before the organs of generation become at all apparent. Hence we may conclude, that they approach, in some respects, to the *Crustacea* and *Arachnida*, and in others to the true insects; but, from the consideration of the presence, the form and the direction of the tracheæ, they must be considered rather as belonging to the latter. Mr. MacLeay has united them with the *Anoplura* (lice), *Thysanoura* (sugar lice, &c.), and some apterous vermes into a class, to which he has applied the term *Ametabola*.

In addition to the characters first above mentioned as distinguishing the *Chilognatha*, it may be mentioned that the legs are very short, terminated by a single

claw; two short antennæ; the mandibles are crustaceous, without palpi, and three jointed; but the more distinguishing character of the *Chilognatha* is the position of the sexual organs near the anterior part, and not the extremity of the body; those of the male being placed behind the seventh pair of legs, and those of the female behind those of the second pair. These animals walk but slowly, and with an undulating motion, produced by the progressive action of the numerous legs; the majority of them, when disturbed, roll themselves up into a ball. They feed upon animal and vegetable substances in a state of decay, and lay a very considerable number of eggs in the earth. From these eggs the young are produced, at first without any appendages to the body; eighteen days afterwards, however (in the genus *Iulus*, according to M. Savi of Bologna, who has made these insects the subjects of two valuable memoirs), the skin is cast, when they appear with twenty-two segments, and twenty-six pairs of legs, of which, the first eighteen serve for locomotion; at the second moulting the animal has acquired thirty-six legs, and at the third forty-three; the body being then composed of thirty segments; and in the adult state, the male has thirty-nine, and the female sixty-four.

A very small species of this group attacks the strawberry, another the endive, others are found in moist places, under the bark of trees, &c.

There are numerous species belonging to this order, some of those from South America acquiring a large size—the *Iulus maximus* being seven inches long. Of the British species, Dr. Leach has given a very good Monograph in the Zoological Miscellany.

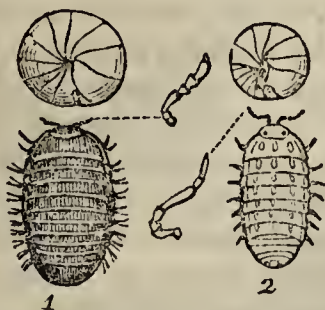
This order is divided by Latreille, in his last work, into three families:—

1st. The *Onisciformes*, having the body of a crustaceous texture and of an oval-oblong form, without pencil-shaped appendages, and capable of being contracted into a ball; the under side of the body being concave. The number of legs is thirty-two in the males, and thirty-four in the females. This family comprises but a single genus, *Glomeris*, Latreille, the species of which are found under stones, especially in mountainous and woody districts. This group is highly interesting to the naturalist, from the remarkable analogy which it presents to certain crustaceous animals, to which the name of wood lice has been given. Indeed, so strong is the relationship, not only in form, size, and general appearance, but also in habits, that it is no wonder that, by the majority of British naturalists, who have, in general, cared too little for more than the outward appearance of things, the *Glomeris marginatus*, belonging to the ametabolous order *Chilognatha*, should have been regarded as a mere variety of the *Armadillo vulgaris*, belonging to the crustaceous order *Isopoda*. We trust that better times are dawning on natural history, as a science, in its legitimate sense, in this country. For the purpose of comparison we have represented the two animals above mentioned, from which it will be seen how close is the proximity between the two groups.

2nd. The *Anguiformes* of Latreille, having the body of a crustaceous texture, but of a long and narrow form, and unprovided with pencil-shaped appendages. Here belong the genera *Iulus* and *Craspedosoma*, having the eyes distinct, and *Polydesmus* in which they are obsolete.

3rd. The *Penicillata* of Latreille, having the body soft, oblong, and furnished behind with small pencil-

like brushes. The legs are twenty-four in number. The genus *Polyxenus*, Latreille, belongs to this family. The type is found in profusion beneath the bark of trees.



1, *Glomeris marginatus*. 2, *Armadillo vulgaris*.

CHILOPODA (Latreille; *Syngnatha*, Leach). An order of wingless insects, corresponding with the Linnæan genus *Scolopendra*, and distinguished by having the body of a leathery-like texture, and depressed, and the antennæ composed of fourteen or more joints. See CENTIPEDES and CHILOGNATHA. Having, in the former of these articles, given an account of the structure and habits of the animals of which this order is composed, it only remains for us, in this place, to give a short sketch of their classification.

Dr. Leach, in the Supplement to the Encyclopædia Britannica, has divided this order into three families.

1st, The *Cermatidæ* (*Inæquipedes* of Latreille's Cours d'Entomologic), having the body proportionably short, with the upper surface protected by eight plates, and with the under divided into fifteen semi-segments, each bearing a pair of legs, terminated by a very long and multi-articulate tarsus. This family, which is composed of the single genus *Cermatia*, is formed of exotic insects, frequently found in houses under beams or joists of the wood work, running with great velocity, and often losing many of its legs when seized.

2nd, The *Scolopendridæ* (*Æquipedes*, Latreille), having the body divided both in its upper and under surface, into an equal number of segments; the legs short and of nearly equal size, the posterior pairs being but little longer than the anterior. Here belong the true *Centipedes*, *Scolopendra*, and the genera *Cryptops* and *Lithobius*, of each of which there are British species.

3rd, The *Geophilidæ* (united with the latter by Latreille), and having a very great number of equal sized legs, the body being narrow and almost filiform, each segment bearing two pairs of legs. Some species are luminous, as the *Geophilus electricus*. Figures of *Geophilus longicornis*, and of *Lithobius forcipatus*, two British species, serving as types of those two families, will be found in our article CENTIPEDES.

CHIMONANTHUS (Lindley). A fine ornamental flowering shrub, a native of China and Japan; Linnæan class and order *Icosandria Polygynia*; natural order *Rosaceæ*. Generic character: perianth scaled; outer lobes like bractæ, inner lobes resembling petals; corolla, none; stamens inserted in the fleshy throat of the perianth; exterior ones perfect and small; anthers adnate and two-celled, interior like threads and downy; styles several and filiform. This plant, on its first introduction into Europe, was called *Calycanthus præcox*; afterwards described as *Meratia*, by Loiseleur Deslongchamps, in his Flora Gallica; but finally named by Lindley in the Botanical Register.

This plant is greatly esteemed by the Chinese, not only for its early flowering and fragrance, but for some medical extract obtained from it, and which is particularly available in counteracting the virulence of the small-pox, so much dreaded by that smooth-faced people. It is almost hardy enough to bear the open air in this country; but as it flowers in winter, and as frost tarnishes the blossoms, the best way to see it in beauty, is to give it a place in the conservatory, or against a south wall in the flower garden. Mr. Sweet states that there are three varieties or species in the London collections, all of which thrive in any kind of garden soil. The plants are usually raised from layers, or by young cuttings planted in sand under a glass, and placed in hotbed heat. Seeds sometimes ripen in this country, whence seedlings are easily raised.

CHINCHILLIDÆ. The chinchilla family, an exceedingly interesting, and, in so far as individuals are concerned, a remarkably numerous group of rodentia, or gnawing animals, inhabiting the southern parts chiefly of South America. The fur of one species (*lanigera*), has been known and highly prized for a considerable number of years; but it is not very long since much was known in Europe, either of the animals themselves, or even of the country of which they were natives.

It has now, however, been tolerably well ascertained that there are three distinct species, if, indeed, they ought not rather to be, as they sometimes have been considered as separate genera.

They all belong to the herbivorous division of gnawing animals, and their teeth are adapted for bruising the hard and dry vegetation upon which, from the peculiarity of their native regions, they are sometimes obliged to subsist, as well as on the more succulent leaves which they can procure in the season of growth. They are all gentle and inoffensive animals, spending great part of their time in their burrows under ground, though in many parts of the plains their burrows are so very numerous, that the horses of travellers and hunters are in constant danger of stepping into them, and throwing their riders, and fracturing their legs.

At one time they were confounded with the hamsters (*cricetus*), to which they have a good many points of resemblance; but still, in their appearance, their structure, and their locality, they are fully entitled to rank as a distinct family, and a family which gave no small portion of its original character to the zoology of the district in which they are found. Nor is it a little remarkable, that two portions of the world, which, from the geographical antipodes to each other, at least, as nearly as any two portions of land of considerable extent should have a remarkable coincidence in their mammalia, even although in climate, as well as in local position, they differ very much. Siberia, especially the southern parts of the steppes, which lie near the bases of the Altaian mountains, have, in many respects, a structural resemblance to the pampas or plains which lie between the Rio-de-la-Plata, and the southern Andes. Both are flat, and composed in great part of sand. Both are, in many places, burnt up at one season of the year, and covered with rich herbage at another, and both are but thinly inhabited, in consequence of the paucity of their productions as serviceable to man; but both contain an immense number of herbivorous rodentia. In respect of its fur animals, Siberia is, indeed, a sort

of union of the two ends of the American continent; the woods furnishing animals not very dissimilar to those which are found, in such vast numbers, to the north westward of Canada, while the open and arid-places present us with those of Paraguay, or rather with animals resembling these in their general habits. But still there is a great difference in the climates of the two places; for, though the southern Andes, on the parallel alluded to, are subjected to more violent storms than any part of Siberia, the plains have a much greater uniformity of temperature, so much so, that up to the very southern extremity of the American continent, vegetation retains a tropical character. We might, therefore, be prepared to expect a considerable difference between the appearance and covering of the animals which perform the same part in the economy of nature in each of the two. And, accordingly, we find the fur upon the American animals much more delicate, and not nearly so well adapted for throwing off snow as that of the Siberians. They are also more gentle animals; and they probably more habitually burrow in the ground.

The characters of the chinchillidæ are,—two simple incisive teeth in each jaw, and four grinders in each side of both jaws. The grinders, as is general in all the herbivorous part of the order, have no roots, and are not produced in the substance of the gum, but grow, adhering to its surface; and, as is the case with all teeth that grow in this manner, they continue growing during the whole life of the animal. Animals of this tribe have all to subsist on very hard food at some season or other; and therefore, this constant growth of the teeth is a very wise provision for them. The teeth of the family under consideration have parallel plates of enamel and osseous matter; and their bruising crowns act directly against each other.

There are three genera, *Lagostomus*, on the east side of the Andes; *Chinchilla*, on the lower slopes of the mountains, and *Lagotis* on the western side. The first genus gets its name of “hairy mouth,” from its remarkably produced whiskers; the name of the second is a country name; and the third is called “hairy ears,” from the large size of these appendages. The first and third are indiscriminately called *Viscacha*; and thus, it is necessary, not to confound the one with other. The first, or eastern one being best known, may be considered as the true *Viscacha*, and, perhaps, for the sake of popular distinction, it may be as well to apply the epithet *Peruvian* to the other.

The *Viscacha* (*Lagostomus trichodactylus*) is about the size of a rabbit. It has also a good deal of the manners of that animal, only it is much less timid, and the vast production of grey fur on the cheeks gives it a very grave appearance. The grinders have two oblique lamellæ in the first three, and three in the last one, at least in the upper jaw: three toes on the hind feet, and four on the fore; thumbs always wanting; nails on the toes, nearly straight, and very strong; the ears and tail of mean size. The colour of this species is grey, of different shades, arising from the points of the individual fibres being of a different colour from the greater part of the length. The skin is of no great value as fur, and the flesh is described as having rather a rank and musky flavour. It is, we believe, sometimes eaten by the Indians, though there is little temptation in a country where wild cattle are to be had for the labour of catching them. The fibres of the covering of this animal are individually

long, but they are coarse, and so few in number, that they do not conceal the skin, so that they are by no means ornamental; and this inutility of the animal, both as food and as clothing, leaves it at peace to multiply to that vast abundance in which it is found in the plains above mentioned.

Chinchilla (*Chinchilla lanigera*). This species is as remarkable for the delicate texture and closeness of its fur as the former is for the opposite qualities; and of the same individual the colour is about uniform all over the body, which renders it very available to the furrier, who can thus obtain an article of large size without any appearance of patching. The fur is so well known, that any description of it would be superfluous; but we may remark, that, notwithstanding its extreme softness, it adheres very firmly to the skin. Some varieties of the chinchilla have been mentioned, but they are at any rate nothing but differences, and very slight differences, of colour; and it is very probable that, as has been the case with some other animals, a clean skin and a dirty one have been described as different species.

The leading characteristics of this animal are: teeth same in number as in the former species, but they have three oblique ridges in each, and the front grinders in the upper jaw are divided into two lobes; the fore-feet have the thumb complete, and consequently five toes; the hind feet have only four toes, and a rudimental thumb. The ears are very long, and the tail partakes of a similar character. It does not appear that this animal is so constantly found burrowing as the viscacha, for it is frequently found lurking in holes of the rocks. It extends geographically over great part of the neighbourhood of the Andes, both in Chile and in Peru, and its numbers are very abundant. It is a much smaller animal than the viscacha, and every way much more delicate in its appearance; but the fineness and closeness of its fur enable it to endure the cold much better.

Lagotis (*Lagotis Cuvieri*) has still the same number and general structure of teeth, but the grinders have three single oblique lamellæ in each. There are four toes on all the feet, the thumb being deficient. The nails are small, and a little knife-shaped. The tail is long, and the ears very long.

In its size, and also in the general shape of its body, this animal very much resembles a rabbit, but the tail, which is equal to the whole body, exclusive of the head, gives it a very different appearance. It is a jumping animal, and has its hind legs of nearly twice the length of the fore ones. The bristly hairs of its whiskers are quite black, very numerous, very closely set, and some of them more than half a foot long. The ears are about three inches long, one inch in breadth, and cut square over at the tips; they are almost entirely destitute of fur. The hair on the fore feet is long and bristly, and almost entirely conceals the claws. The inner toe on the fore feet is flattened, curved inwards, and has its inner margin beset with stiff bristles, which have nearly the consistency of a small comb. This last circumstance is not, however, peculiar to it, for it occurs also in the chinchilla.

The hair of this animal is very soft and downy, of considerable length, and beautiful in appearance, but it adheres so slightly to the skin as to render it of no value to the furrier. The base of the hairs is dusky, and about a quarter of an inch at the tip, of a dull

white, with more or less of a brownish tinge. Besides this very soft fur, there are bristly hairs scattered thinly over the body of the animal, which are of a black colour. This animal is found chiefly upon the



margins upon those dry and sterile plains which lie between the Andes and the Pacific, intermediate between Chile and Peru, though it is met with to a considerable extent over both these countries. From the tenderness of its covering, it is not, though a stronger and larger animal, so able to bear the severity of winter in the Andes as the Chinchilla, though it is not so decidedly an animal of the plains as the viscacha of Paraguay. It is possible that both species may occur both in the east and the west of the mountains, though, for great part of the ridge, the summits are so elevated, the weather upon them so severe, and the passes so difficult, that they form nearly as impassable a barrier to all animals that cannot fly as the same extent of the ocean itself. It is highly probable that there are more species, or, at all events, varieties of this family, at one place or another of the country in which the known ones occur; but on this, as on very many other points in the natural history of South America, our information is still very imperfect, though it is making a very rapid progress, especially of late years, and since the Spanish colonies threw off the yoke of the mother country.

CHINESE ROSE is the *Hibiscus rosa Sinensis* of Linnæus. It is in no way connected with the *Rosa indica*, which is a species of the common European rose; but it is so called because the form, colour, and number of the flowers of the Hibiscus, when seen at a distance, resemble, in their native country, the rose tree of England. This *hibiscus* is indeed a highly ornamental plant, and as the flowers are of different tints, even on the same plant, they are great favourites of the Chinese, as well as of European residents in India, who plant them in the shrubberies round their houses. They strike root readily from cuttings.

CHIOCOCCA (Willdenow). A genus of West Indian shrubs lately introduced into our collections. Linnæan class and order, *Pentandria Monogynia*; natural order, *Rubiaceæ*. Generic character: calyx pitcher-shaped, five-toothed; corolla funnel-shaped, throat bearded, stamens included; stigma entire; berry pulpy and two-seeded. This is called the snowberry-bush, from the colour of the fruit. It is easily propagated by cuttings treated in the ordinary manner.

CHIONANTHUS (Linnæus). Fine ornamental North American trees and shrubs, common in our pleasure-grounds. Linnæan class and order, *Diandria Monogynia*; natural order, *Oleincæ*. Generic character: calyx four-parted, persisting; corolla tube short, limb cut into many linear divisions; stamens have short

filaments seated within the tube; anthers heart-shaped and erect; style short; stigma three-cleft; drupe one-seeded. This handsome plant is called the fringe-tree, from the elegant form and position of its flowers. The leaves are also large and showy. Plants are raised from imported seeds, or propagated by grafting on the common ash.

CHIRONECTES. A genus of spinous-finned fishes belonging to Cuvier's thirteenth family, or those which have the pectoral fins pedunculated. They have the carpal or wrist-bone so much produced as to form a peduncle to the fin, which has some slight resemblance to an arm, to which the fin itself serves as a sort of hand. The present genus bears some resemblance to the frog fishes, or anglers, which are remarkable for their grotesque form. They have prominent appendages to the head, which form a crest, sometimes terminating in a sort of membrane, and at other times in a sort of fin. Their head and body are compressed; their mouth opens vertically; their gill-flaps consist of four rays, and there is no gill-opening, but a small hole behind the dorsal fin. They have four gills. Their dorsal fin occupies the whole length of the back. They are furnished with a very large swimming bladder. Their intestinal canals are of mean length and without any cæca; but their stomachs are very large, so that they can, upon occasion, puff themselves up like a balloon.

They are found chiefly in the muddy bays and estuaries of tropical seas, and, contrary to the habits of most fish, they do not retreat with the tide. There are, indeed, few fishes which can bear the absence of water longer; for they may be kept on land for two or three days, with little falling off of their activity. They obtain the name of frog-fishes, from their hopping along the surface of the mud at low water, very much after the manner of these reptiles; and in some of the bays on the north coast of Australia, where the violent rains wash the soil into the sea, they may be observed at low water hopping about in great numbers. Their pectoral fins, which have a great deal of muscular action, are made use of as feet on their march over the mud; and though they do not use these alternately in stepping, they can spring to the height of several feet, and the distance of a yard or two. This curious mode of marching is by no means an idle sport with them; for immense numbers of insects hover over the mud in those hot climates, and these fishes spring up and make prize of them. There are a considerable number of species, which are chiefly distinguished by the different appendages to the skin, some of which are spines, and capable of inflicting rather unpleasant wounds, though in this respect they are not so formidable as some of the allied genera. They are by no means handsome fishes, nor does it appear that they are eaten even by the rudest people.

CHIRONECTUS. A genus of marsupial animals, of aquatic habits, and but for the fact of its being marsupial, while the otters are not, it bears a considerable resemblance to the otter, and is called the little otter by European settlers in those parts of the world where it is found.

The characters are:—six incisive teeth in the upper jaw, and eight in the under; two canines in each; the number of grinders indefinite; the muzzle pointed; the eyes directed laterally; the ears naked, and membranous; five toes on all the feet, of which the hind ones only are webbed; no nail on the thumb of the

hind feet, but crooked claws on all the others; plantigrade in walking; tail cylindrical, covered with scales, and prehensile. There is only one species which is often described as the palmated or web-footed opossum. This species is *CHIRONECTUS YAPAK*, the Yapack. It is found in the rivers of Guiana, and the adjoining parts of South America. It is a small animal, not a foot in length, with a tail of six or seven inches. The form of the head is long and pointed, the muzzle very slender, and the ears large and naked. The tail is naked, with the skin granulated like shagreen leather, and with scaly plates on the under side. The ground colour of the body is greyish yellow; the upper part being marked with blackish brown spots. These spots or patches, which are of large size, give rather an elegant marking to the animal. There is one between the eyes, another on the top of the head, and a third and broader one on the shoulders, which is continued down the front sides of the fore legs to the toes, which are blackish, a fourth of a rounder shape on the middle of the back, and one on the rump, which extends some way down the hind quarters, but not to the legs. Three are united down the back by a narrow dorsal line. The cheeks, and the under part, are marked with pale yellow ash, inclining to white. The general expression of the animal may be judged of by inspection of the annexed figure.



Chironectus Yapak.

It is highly probable that, when the banks of the rivers and streams in South America have been examined with sufficient care, there may be found many species; or at all events varieties of these fresh water marsupial animals, occupying the same place in the natural history of that part of the world, as the water rats and water mice occupy with us. Mention has been made of some as having been met with both in Brazil and in Peru, or on the very opposite sides of the continent. Of these, one is said to have been not more than two inches in length. The larger ones, such as the Yapack, feed in part upon small fishes; and it is probable that the smaller ones may live upon water insects; but the country in which they have been seen is so extensive, and has been viewed by scientific eyes at so few points, that all the information which we have, amounts only to a very rude guess at its natural history. America is among the latest additions to the known parts of the world; and, in the southern parts of the mainland and the islands especially the very abundance with which nature has endowed it, has been the means of keeping us in ignor-

ance of its natural history. The gold and silver of the Andes, and the vegetable wealth of the islands and the alluvial parts of the mainland, have so captivated the bad passions of men, that they have not attended to the productions and the working of nature with even half the attention which has been bestowed upon the most sterile parts of the globe.

CHIRONEMUS. A genus of spinous-finned fishes belonging to the perch family. They have seven rays, and are without the crooked teeth which characterise perches. There is only one known species, a native of the Australian seas.

CHIRONIA (Linnæus). A beautiful genus of undershrubs, natives of the Cape of Good Hope. Linnæan class and order, *Pentandria Monogynia*; natural order, *Gentianeæ*. Generic character: calyx in five divisions; corolla open bell-shaped, limb five-cleft; stamens bearing oblong erect anthers; stigma round; capsule united to the calyx. The chironias should be in every greenhouse, as they are free flowerers, and bear purple, or red or white blossoms. They are easily propagated by cuttings, and require to be often renewed by this means, as old plants become irregular in growth, and unsightly.

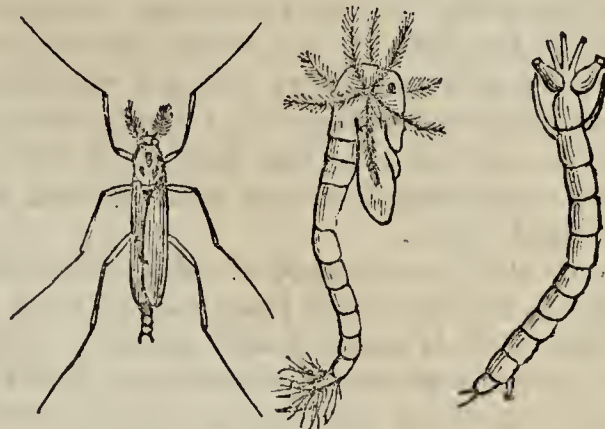
CHIRONOMUS (Meigen). A genus of dipterous insects belonging to the great family *Tipulidæ*, and to the sub-family *Culiciformes* of Latreille. The insects of which this very numerous genus is composed are of small size, and are often, but inappropriately, termed gnats, that name being, as it seems to us, more strictly applicable to the *Culicidæ*, from whose stings, or rather bites, we have so often cause of inquietude and alarm. We would apply to the present and other harmless insects belonging to the former family the name of *Midges*. Generally these insects are distinguished by the beautiful antennæ of the males, which are thirteen-jointed, and form a complete feather, being entirely enveloped in a pencil of hairs reaching to the tip; those of the females are clothed with a few short hairs, and only six-jointed, the terminal joint being very long. The abdomen is long, slender, and hairy, the legs long and slender, the anterior tarsi being often very long, and seldom employed in walking, and the wings are laid parallel upon the back during repose.

It is these insects which are so often observed in fine summer evenings hovering in great swarms over moist situations, and alternately rising and falling with a motion somewhat like that of the May-flies, *Ephemera*. In the Linnæan system the midges formed portion of the genus *Tipula*, which from its great extent has been separated by modern authors into numerous generic subdivisions; they resemble the true gnats, but the proboscis which in the latter is so direful an organ is here nearly rudimental. Like the gnats they reside in the larva state in water, and are provided with various organs for respiration, which they continually apply to the surface in order to procure a sufficient supply of air. The larva of the common *C. plumosus* has been observed by De Geer and others. It is long, slender, worm-like, and may constantly be seen in stagnant water and ditches, being of a red colour, whence it has obtained the name of the blood-worm, its body is articulated, and its tail is furnished with several short fin-like appendages for respiration. These larvæ form long cylindric tubes in the banks, in which for the most part they reside, and in which they change to pupæ. An anecdote is recorded respecting these blood-

worms, which is quite sufficient to prove that, in this case at least, even a little knowledge of natural history would not have been a dangerous thing. A medical gentleman having observed these larvæ very numerous in the water of a well, in the neighbourhood of Cork, considered them to be the true origin of the common small thread-worm (*Oxyurus vermicularis*) occasionally found in the human intestines, the former differing only from the latter in colour. Had he, however, but placed some of these worms in water of a temperature equal to the human body, he would soon have discovered that they were not long able to bear the increased heat of their native element.

Reaumur found the larvæ of one of the species in small brown paper-like cases, attached to various leaves which had fallen into the water in the Bois de Boulogne; the cases were of a flattish spindle-shape, somewhat resembling an oblong seed, they were chiefly composed of silk, but Reaumur could not ascertain whether fragments of leaves might not also be employed in their composition. We are unable to decide as to the precise species observed by this author, but from his description it seems nearly akin to the *C. plumosus*. The fore legs are much longer than the others, and generally carried in an elevated position by this insect, so that they might easily be mistaken for antennæ; moreover, they are generally kept in continual motion, now elevated, now depressed, whence the origin of the generic name, signifying a kind of gesticulation with the hands. The pupa has the head and thorax united into an oval mass, with the abdomen long and cylindric; from each side of the thorax arises an elegant apparatus composed of five long finely feathered rays disposed in the form of a star; the tail is also ornamented at its extremity with a fine brush of hair. The fore legs, from their general length, are inclosed in cases which, instead of folding upon the breast in the same way as the shorter hind legs, project from each side of the thorax in a very peculiar manner. Messrs. Kirby and Spence have given a very interesting account of the manner in which the insect, upon arriving at its perfect state, in which it is destined to pass its life in the air, effects its escape from the puparium, or skin of the pupa, the natural element of which is the water. For the extrication of the imago it is necessary that it should remain quietly suspended at the surface, and moreover that the thorax in which the opening for its exit is to be made should be at least level with it, and this is precisely what takes place. By a most singular and beautiful contrivance, not only is the pupa which is specifically heavier than water enabled to suspend itself without motion at the surface, but its thorax which is the heaviest end is kept uppermost. This is effected by the property which the centre of the thorax has of repelling water, hence as soon as the pupa has once forced this part of the body above the surface, the water is seen to retreat from it on all sides, leaving an oval space in the disk which is quite dry, hence the attraction of the air to the dry part of the thorax is sufficient to overbalance the specific gravity of the pupa. If, however, when the pupa is suspended at the surface, a drop of water be let fall upon the dry portion of the thorax, it instantly sinks to the bottom, the thorax which belongs to the heaviest half being the lowest, but if the pupa be again brought to the surface so that the fluid is repelled from its disk, it remains suspended there without effort as before. Just previous to the exclusion of the fly, the

dry part of the thorax is seen to split in the middle. The air enters and forms a brilliant stratum resembling quicksilver between the body of the insect and its puparium, and the former, pushing forth its head and fore legs, like the gnat, rests the latter upon the water, and in a few seconds extricates itself wholly



Larva, pupa, and perfect Chironomus.

from the puparium. A more recent author has endeavoured to throw some doubt upon the mode of solution of the manner in which the suspension is effected, asking in reference to that part of Messrs. Kirby and Spence's statement, which he quotes entire, which relates to the sinking of the insect when a drop of water is let fall upon it. "If so, we may ask what becomes of the power of the thorax to repel water?" We answer that, although the thorax may possess the power to repel the water immediately surrounding it in a quiet and undisturbed state, it does not follow, and indeed it would be absurd to suppose that it possessed a power of repulsion sufficiently strong to resist the increased force of a drop of water let fall upon the heaviest portion of its body, especially at a period when the feeble creature is just as it were upon the point of bursting into life; indeed in support of this opinion, we again find the same author adopting another idea of Messrs. Kirby and Spence, namely, that these midges fly unwetted in a heavy shower of rain, owing to their quickness of vision, since if the drops, bigger than their own bodies, fell upon them, they must be dashed to the ground, although he immediately takes up the idea of repulsion which he had before thrown down, and "unless it may be that the drops glide off their wings as they do off the feathers of a duck."—*Insect Transformations*, 319, 367.

There are nearly a hundred British species of this genus, some of which are remarkable for the elegance of their colouring. Many of them form beautiful subjects for the microscope.

CHIROTÉS. A genus of saurian reptiles, which may be considered as intermediate between the lizards properly so called and those serpents which have rudimental bones of the extremities. From the circumstance of having only two feet, this genus, or we may say, this species, for there is but one, has been rather absurdly called *Bimana*; but as that is the proper distinctive name of the human race in natural history, and as no animal but man is possessed of what can properly be called a hand, the extremities of apes and monkeys being merely grasping feet, it is of course improper to apply the term *bimana* to any species but the human race. This animal is the *Lacerta lumbricoides* of Shaw, but it cannot, strictly speaking, be considered as a lizard, and it has no resemblance whatever to an earth-worm (*lumbricus*) in any one respect, except colour. It is one of those singular animals of which two or three are met with in Mexico, and which have always puzzled the syste-

matists where to place them. The characters are: the head round, blunt at the muzzle, distinguished from the body by a simple fold, and covered with polygonal scales, which are large for the size of the animal but few in number; the nostrils and eyes are not very conspicuous; the jaws are of nearly equal length; the body is long, cylindrical, covered with rather large four-sided scales, which are similar both on the back and the belly, and are verticillate or placed in whirls round the body; there are only two feet which are very near the head, well developed, and each containing five toes with distinct claws; and the tail is blunt.

There is only one species, *C. Mexicanus*, which is about eight or ten inches long, and as thick as the little finger. It is marked with about two hundred and twenty rings of scales, which form a half ring on the upper part of the body, and another on the under, meeting each other at two lateral lines, which are very straight and very definite. There are two lines of pores on the under part of the body; the tongue is a little extensible, and terminates in two small horny points; its ears are covered with the skin, and consequently not visible externally. It is of a flesh colour, and in this, in its general appearance, and its being possessed of only one large lung, it approaches in character to amphibia among the serpents, but in its skeleton it is very different. The bones of its two feet are well developed, having distinct blade-bones, and being supported by clavicles butting against a small sternum. Thus it can use its two feet with great dexterity in walking, in climbing, and in grasping. Altogether this is one of the most singular animals with which we are acquainted, and the different parts of its organisation would lead to the placing of it in very different parts of the system. The bones are understood, though this point has not been very well ascertained, to resemble, in their general texture, the bones of warm-blooded animals more than those of reptiles, while the general external characters bear at least some resemblance to those of the lizards, and respiratory system to that of the serpents. This animal is understood to be entirely insectivorous, and it is perfectly innocuous.

CHISMOBRANCHIATA (Blainville). Second order of the second class of molluscs, *Paracephalophora*. The animals of this order possess aquatic organs of respiration, branchial or pectinated, placed at the anterior part of the back, in a large cavity, communicating with the ambient fluid by a large oblique, anterior slit. Mouth without teeth, but the lower part furnished with a lingual muscle; some are without shells, some are interior or external, very flat, aperture very large, entire, and without a columella. This order includes the genera *Coriocella*, *Sigaretus*, *Cryptostoma*, *Oxinoë*, *Soumatella*, and *Velutina*. The order is composed of shells, all of which are marine, and the animal probably herbivorous.

CHITON (Linnæus, Cuvier, &c.) This singular mollusc has undergone no change by the arrangement of modern naturalists; its characters are so well defined, and possess so few variations, that it cannot by any possible chance become blended with other genera. It is a genus perfectly distinct from all other of the animal series; *they seem to form the transition from molluscs to insects*. The separation of this genus into small natural groups is attended with much difficulty; it may, however, be ultimately accomplished by careful study of the animal and its

covering. The only certain guide hitherto pursued, are the sides of the valves, and the number of tooth-like processes each presents, when detached from the membranous substance which surrounds them; the striæ, granulations, punctures, and other external markings, also assist in classing the species. Lamarck observes respecting this well known but singular mollusc, that it seems more like an univalve than a multivalve, and should only be considered an elongated shell, with the testaceous portions of it transversely broken by nature, at its first formation, into a number of distinct moveable parts, in order to facilitate the animal's motion. These valves or testaceous portions may be considered never to vary in characteristic marks, beyond eight in number, though instances have been met with of specimens with only seven. These are inserted at the lateral extremities by certain toothed processes above alluded to, into a tough ligament surrounding the outer margin, firmly uniting them together in their proper position; this ligament is sometimes fleshy, coriaceous, smooth, wrinkled, covered with scales, or beset with tufts of hair; and in one species *Chiton spinosus*, it has numerous tubular, slightly curved, long thin black spines; a tough internal membrane connects the under part of the valves or portions, allowing the animal to contract its shell in a globular form or fully to expand it. When these valves are all united on the animal's back, they form an elliptical shell, the centre part of which is more elevated than the rest; the valves slightly overlap each other, and each succeeding one is less convex towards the margin. One species has callous adhesions longitudinally placed on the back of the valves; some are elegantly marked by the arrangement of their striæ, granulations, &c. The interior of the valves is generally white, but some are green, and one species a bright rose-colour; they adhere to rocks covered by the sea, to the backs of tortoises, fishes, or other marine objects, and so fast do they retain their position by exhausting the air beneath their bodies, that it requires a strong lever to detach them, frequently breaking the shell before the animal can be forced from its position. The name chiton, is derived from the Greek, and means a coat of mail. The animal in its structure is not less singular than the shell; its body is more or less lengthened, depressed, or sub-cylindrical, obtuse equally at both ends; the abdomen provided with a muscular disc or foot, adapted to climbing, but most particularly to adhesion; the back is sub-articulated, and corresponds with the different valves; the mouth is anterior, and beneath, in the middle of a considerable mass; it has neither eyes, tentacula, or jaws, but it has a sort of straight tongue in the buccal cavity, bristled with denticles. The organs of respiration are branchial, and formed by a succession of small branchiæ beneath the turned edge of the mantle, particularly at its back part. De Blainville places the chiton in the second class *Polyplaxiphora*, of his sub-type of *Malentozoaria*, and he subdivides the genus into the following well-defined species:—1st, Such as are depressed with large valves, carinated, much imbricated, the intermediate ones presenting well marked lateral areas, the limb of the mantle regularly scaly, without hairy or silky tufts, as in the *C. squamosus* here figured. 2ndly, The sub-depressed species, with valves not carinated, much imbricated, and without marked areas, the lateral portions of the mantle covered with a species

of hair or calcareous tubercles, as in the *C. marmoratus*. 3rdly, The species, whose form are similar to the preceding, the valves generally smaller, all the terminal ones much imbricated, without marked areas; the lateral portion of the mantle either quite naked, or as if coriaceous, as in the *C. piceus*. 4thly, The species more or less cylindrical, vermiform, nearly naked; the foot very narrow, as if articulated; the branchia in the posterior half of the body only; the valves very small, often separated or not imbricated, and always visible, as in the *C. lævis*, constituting Lamarck's *Oscabrella*. 5thly, The species with the valves narrower, imbricated, without distinct areas, the lateral parts of the skin naked or hairy, but always furnished with tufts of silk or hair, arranged in pairs, as in the *C. fascicularis*; and lastly, Such species as are more or less cylindric, vermiform, nearly naked, the valves of the shell very small, almost entirely concealed beneath the skin, with tufts similar to the preceding section, as in the *C. larvæformis*, which constitutes Lamarck's genus *Chitonellus*. These shells sometimes attain a large size, measuring four inches in length; but they usually do not exceed two inches. They are found in every sea, the larger ones in warm latitudes; but the shells of the last division have only as yet been found in Australia. One of a small size is found on the British coast. Fossil species are rare, but detached valves are sometimes met with in the calcareous sand formation, in the neighbourhood of Paris.

CHITONELLUS (Lamarck). A species of mollusc, forming one of the divisions of the genus *Chiton*, of De Blainville's system (which see). It inhabits the coast of New Holland, and from its external valves never being interlocked, it has the power of moving laterally as well as forward.

CHITONIA (D. Don). Handsome shrubs and trees, natives of South America and the West Indies. Linnæan class and order, *Decandria Monogynia*; natural order, *Melastomaceæ*. Generic character: calyx of four parts, deciduous; petals orbicular; stigma pellate and hemispheric; seed vessel four-celled, four-valved; seeds two in each cell; arillo fleshy and banded. The plants of this genus were formerly included in the genus *Melastoma*, but have been separated by Mr. D. Don.

CHIVES. A diminutive species of the onion tribe, called by botanists *Allium schænoprasum*. It is not bulbous; but grows in thick tufts, producing an abundance of slender delicate leaves, having the true onion flavour, and very useful in dressed salads, when small green plants of the common onion are not to be had. There is, or always should be, a small bed of chives in the herb border, the leaves being often useful in cookery, as well for garnishing as for salads. There should also be a few pots of chives kept in every garden, in order to be placed in a hot-bed or hot-house, to afford a supply during winter. In the open ground they require to be frequently cut off, to induce a fresh growth of leaves. Chives are propagated by divisions of the root, and like a shady situation.

CHLÆNIUS (Bonelli). A very extensive genus of *Coleopterous* insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Harpalides*, and to that subdivision in which the anterior tarsi alone of the males are dilated, the basal joints being large, square, or rounded, or the *Patellimanes* of Dejean. The palpi are rather long, with the terminal

joint slightly oval, squared off at the tip; the tooth at the middle of the chin is bifid, and the three basal joints of the males are dilated. These insects are amongst the most elegant species of the family, being ordinarily of a fine opaque green colour, and clothed with a down, whence their generic name; some few species have, however, the body smooth and shining. They appear to be distributed over the whole surface of the globe; none, however, are yet recorded to have been found in New Holland. They emit a very powerful and disagreeable alkaline odour. The Count Dejean has described sixty-six species in his "Species Général," but in his new catalogue there are 115 belonging to this genus. There are seven or eight British species, of which the *Carabus marginatus*, Linnæus, (*Vestitus*, Fabricius,) is the most abundantly met with. Their habits do not materially differ from the other allied genera.

CHLAMYPHORUS. A genus of mammalia belonging to the order *Edentatæ*, and nearly allied to the armadillos, though different from them in many respects. The characters are: ten teeth of uniform size; five toes on each of the feet, with nails on the fore feet very strong, crooked, compressed laterally, and forming very powerful weapons either for digging or for defence. The back is covered with a succession of scaly pieces ranged transversely; but there is no shell either at the anterior or the posterior part, as is the case with the armadillos. These pieces are attached to the spine only. The animal is not above five or six inches long; like the rest of the tribe it is found in the interior of South America, and it spends the greater part of its time under ground, for burrowing in which its powerful claws on the fore feet are well adapted.

CHLAMYS (Knoch). A genus of coleopterous insects, belonging to the section *Tetramera*, and family *Chrysomelidæ*, comprising a considerable number of minute but curious species from Brazil, having the body short and very irregular above, the head vertical, the antennæ short and serrated, and the labial palpi furcate. Two excellent monographs of this interesting genus have been given by Messrs. Kollar and Klug; some of the species have the appearance of morsels of rough precious stones, being of a rich metallic colour. In their habits they are, probably, herbivorous, like the majority of the family to which they belong.

CHLENACEÆ. A natural order of dicotyledonous plants, containing five genera and eleven known species. Many authors consider this order as allied to the mallow tribe, on account of its involucreted flowers, and monadelphous stamens. Jussieu however thinks that, in consequence of its petals coalescing at the base, and its seeds being albuminous, it bears an affinity to *Ebenaceæ*, or the ebony family. The plants of the order do not seem to be sufficiently well known to enable botanists to determine their exact position in the natural system. The essential characters of this order, as given by Decandolle, are: involucre one to two-flowered, persistent, varying in form and texture; sepals three, small; petals five to six, hypogynous, broad, and sometimes slightly coalescing at the base; stamens sometimes numerous, at other times only ten; filaments somewhat combined into a tube at the base, or adnate with the tube of the petals; anthers two-celled, roundish, adnate or free; ovary single, three-celled; style one, filiform, stigma triple; capsule three-celled, or by imperfection only

one-celled; seeds solitary or numerous, fixed to the centre; albumen fleshy or horny; embryo green, central; cotyledons foliaceous, waved.

The plants belonging to this order are small trees or shrubs, with alternate, stipulated, entire leaves, and paniculate or racemose flowers. They are almost all natives of the Island of Madagascar. The genera of the order are *Saccolæna*, *Leptolæna*, *Schizolæna*, and *Rhodolæna*. To these Decandolle has added the East Indian and Mauritian genus *Hugonia*, which he considers allied to the order *Chlenaceæ*, but differing from it in being destitute of an involucre to the flower. This genus is also allied to *Malvaceæ* and *Byttneriaceæ*, but is distinguished from them in having an imbricated, not a valvate, calyx.

Very little is known in regard to the properties of the plants of this order. *Leptolæna multiflora*, and the species of *Schizolæna*, are handsome small trees with fine flowers, while *Rhodolæna altivola* is a climbing shrub, with large purple flowers. The genus *Hugonia* was named by Linnæus in honour of Dr. Augustus John Hugo, of Hanover, who was a great friend of Haller. *Hugonia mystax*, a native of Ceylon and Malabar, is a slender shrub twelve feet high, with numerous short leafy branches, each of which bears about its middle a pair of remarkable revolute spines. The resemblance of these to a pair of *moustaches*, is said to have given origin to the specific name *mystax*. The plant bears yellow flowers, and a shining fruit, containing a red tasteless pulp. The wood has a reddish-brown colour, and possesses an aromatic odour. The root has been applied externally to inflammatory swellings, and also to the bites of the hooded snake (*coluber naja*). Internally it has been recommended in worms and the febrile diseases to which children are liable.

CHLIDANTHUS (Herbers). An ornamental and highly fragrant bulbous plant, introduced from South America in 1820. Linnæan class and order *Hexandria Monogynia*; natural order *Amaryllideæ*. Mr. Sweet observes of this plant, that it requires no water when not in a growing state; and if planted in the open borders in spring it will flower in the summer, but must be taken up in autumn, and kept dry through the winter; or if left in the ground requires covering from frost.

CHLORA (Linnæus). A genus of two annual plants, one of which, *C. perfoliata*, is a native of Britain. They belong to the natural order *Gentianeæ*.

CHLORANTHÆ. A natural order of dicotyledonous plants, containing three or four genera, and a few species. It is nearly allied to *Piperaceæ* and *Laurineæ*, but differs from these orders in the absence of a sac to the embryo, and in having a pendulous ovule, and opposite leaves with intermediate stipules.

The following are the botanical characters of the order: flowers naked, spiked, perfect or unisexual, subtended by a scale; stamens lateral, if more than one, connate, definite; anthers one-celled, bursting longitudinally; filaments slightly adhering to the one-celled ovary; stigma simple, sessile; ovule pendulous; fruit a drupe, indehiscent; embryo minute, placed at the apex of a fleshy albumen, with an inferior radicle.

The plants belonging to this order are herbs or under shrubs, with jointed stems, opposite simple leaves and terminal green flowers. They are inconspicuous, and are not considered as ornamental in gardens. They are found in tropical regions, and

inhabit the hot parts of both the East and West Indies, as well as South America. They have generally an aromatic taste, and possess stimulant properties. The chief genera of the order are *Chloranthus*, *Hedyosmum*, and *Ascarina*.

Chloranthus is the genus which gives name to the order. The whole plant of *Chloranthus officinalis* has a fragrant aromatic odour, which is lost by drying. The roots of the plants however retain, even when dry, a smell like camphor, and have a bitter aromatic flavour. They possess heating and stimulant properties, and may be used in place of snake-root in promoting the action of the skin and kidneys. The root of *Chloranthus inconspicuus* has the odour of seneka root, and is said to possess similar qualities. The leaves of the plant are used in decoction, for the cure of intermittent fever.

CHLORANTHUS (Swartz). A genus of three Chinese herbs and under shrubs, bearing green-coloured inconspicuous flowers, but having an agreeable scent, for which they are kept in stoves and propagated by cuttings.

CHLORION (Latreille). A beautiful genus of hymenopterous insects, belonging to the division *Fossoræ*, and to the family *Sphegideæ*, or sand-wasps. The body is rather long, highly polished, and metallic; the head broader than the thorax; the antennæ inserted close to the mouth, and the second submarginal cell narrow, especially near its union with the marginal cell; the tarsal claws have a tooth near the middle. These splendid insects are above the middle size, and owe their generic name to the brilliant metallic green colour with which they are adorned. The habits of one of the species of this genus, *Sphex lobata*, Fabricius, were observed by M. Cossigni, who states that it is a rare insect in the Isle Bourbon, although very common in the Isle of France; it flies with rapidity, entering the houses, flying about the window-curtains, and creeping into their folds; when settled it is easily caught: but great caution must be used, as it is provided with a sting even more powerful than that of the bee, this fly protruding its weapon to a greater distance than the bees ordinarily do. In the Isle of France the domestic bees are not observed, although they abound in the woods of the Isle Bourbon; their rarity in the former instance being attributed to the presence of the chlorions, which drive them away. M. Cossigni observed an encounter between a cockroach and a chlorion. After regarding each other for a moment, the latter pounced upon the blatta, seizing its head with its jaws, and curving its body so as to sting the belly of the cockroach. When it had effected this, it dismounted, quitted its victim until the poison which it had introduced into the wound should have begun to operate, when it returned, seized it by the head, and, dragging it along backwards, deposited it in a hole in the wall. When its prey is too large to enter the aperture, the chlorion deliberately clips off its wings and wing-cases, and even its legs, so as to enable it to force it into the burrow. The object of this slaughter is the laying up of a sufficient supply of food for the future progeny of the chlorion; hence, as is generally the case in insects, the task devolves upon the females, and, indeed, it is this sex alone which is provided with the powerful sting which is so important an instrument in the operation. We have detailed a somewhat similar course of proceeding in the *CERCERIDES*. See our article upon this group.

CHLOROPS (Meigen). *Oscinis*, Latreille. A genus of dipterous insects, belonging to the section *Athericera*, and family *Muscidæ*. The head is nearly spherical; the legs are of moderate size and thickness, and the body short and not filiform; the antennæ are short, and have the seta not branched. These insects, which are of small size, are amongst the most obnoxious of the diptera, attacking various kinds of corn, and almost equalling in their ravages the *Cecidomyiæ*. They are of small size, smooth, polished, and of a black colour more or less variegated with yellow. To this genus belong the *Musca Frit* of Linnæus, and the *Musca pumilionis* of Bierkander, together with upwards of twenty other British species. The first of these insects, although stated by Messrs. Kirby and Spence not to have been discovered in Britain, is doubtfully introduced by Mr. Stephens into his Catalogue of British Insects. This fly, according to Linnæus, occasionally destroys in Sweden not less than a tenth part of the crops of barley, the loss being estimated at 100,000 golden ducats. The mischief is effected by the insect getting into the ears. An interesting account of the chlorops pumilionis is given by Mr. Markwick, with additional observations by Mr. Marsham, in the second volume of the Linnæan Transactions. This insect was at first considered as the Hessian fly, and no small alarm was produced in consequence thereof; but the latter author, by pursuing a series of observations by which the real species was determined, proved the incorrectness of such a supposition. Early sown wheats are especially liable to the attacks of this fly, the grub of which feeds within the principal stem, just above the root, thereby entirely destroying it; the root, however, throws out side shoots, so that the injury is not so great as it was at first supposed that it would have been. The perfect flies, as we have stated in our article on the *Cecidomyiæ*, abound in the autumnal months*, swarming in our apartments, so that, from the short-lived existence of dipterous insects in the perfect state, it seems necessary that, as the flies are produced from the early sown wheat in May, there should be an intermediate generation to produce the autumnal brood; direct observation is, however, required upon this point. This insect is under a quarter of an inch in length, the thorax having two lateral yellow lines. The maggot is white and fleshy. It is at the period when the wheat is about six or eight inches above the ground (as we learn from a friend who has lately reared some of those destructive insects), that the chief injury is committed.

CHLOROXYLON (Decandolle). A lofty East Indian tree, called *Swietenia chloroxylon* by Roxburgh. It is the green mahogany of the east, and as useful timber is estimable for many purposes of building. Chloroxylon is also the specific name of one of the West Indian laurels.

CHOANITES. A name given by Mr. Mantell, in his Geology of Sussex, to a genus of fossil zoophytes, which are very numerous, and appear to hold an intermediate place between the *Alcyonia*, properly so called, and the *Ventriculites*. They are distinguished from the former by their having a central cavity in their upper part, and, from the latter, by their being without an external reticulated integu-

ment, &c., and possessing a very slight degree of contractile power. Their forms are various, being generally either funnel-shaped, spherical, globular, or subcylindrical, having a central opening in their superior part, and appearing to have been originally composed of a parenchymatous substance, capable of imbibing moisture, and of contraction in a slight degree. The base was fixed.

The *Alcyonium ficus* of Linnæus may be considered as the type of this genus. Parkinson, in his Organic Remains, describes this zoophyte as follows:—"It is of the form of a fig, being attached to rocks by branches proceeding from its smaller end; the upper part is a little flattened, and has a cavity in the centre. Its colour resembles that of tobacco, and its parenchymatous substance cannot be compared to any thing better than to nut-galls when well dried." Org. Rem., vol. ii., p. 96.

The remains of this genus, which were formerly indiscriminately placed among the *Alcyonia*, were first noticed by M. Guettard, at Verest, and at Mont Richard, in Touraine, and were described by him in a paper published in the Memoirs of the Academy of Sciences of Paris, 1757.

He observes that they are of a globular form, having in many examples the base elongated into a pedicle. In the centre of the superior part is a circular opening, generally filled with the substance in which the fossils are embedded. The cavity is larger in its upper part than in the lower, and is continued almost to the pedicle, in some specimens appearing even to pass through it. From the circumference of the opening, lines may be traced that not only pass over the whole of the spherical part (where they form striæ more or less distinct), but also penetrate the substance of the zoophyte. There is seldom more than one opening, but instances have occurred in which three have been found. Very accurate representations of these fossils are given in Parkinson's Organic Remains, vol. ii., pl. 9, figs. 1, 3, 4, 6, 8, and pl. 11, fig. 8.

Three species are described by Mantell. The first of these, the *Subrotundus*, is that generally termed by collectors the *Ficoid alcyonite*, from its supposed resemblance to the fig. The surface is smooth, and entirely without markings, and the cavity nearly circular. The second, the *Flexuosus*, is cup-shaped, the margin of the central depression being marked with flexuous indentations. The radical processes are all long and fibrous. This species is very rare, and, as well as the former one, is found in the Upper Chalk, near Lewes in Sussex. The *Konigii* is the third, and is described as "inversely conical, externally marked with irregular fibres, some of which penetrate into the substance of the fossil, and terminate in openings on the inner surface. The central cavity is cylindrical, deep, and narrow, and the base fixed by the radical processes." This species is generally enveloped in large irregular flints, which exhibit but slight traces, externally, of the body which they inclose. The superior part presents a convex surface, with a cylindrical body in the centre, whence interrupted fibres ramify in a radiating manner towards the margin. Numerous perforations may also be observed at the base, which, without doubt, afforded a passage for the radical processes. They are found in abundance in the loose flints beneath the turf, near Lewes race-course, and appear to have been of frequent occurrence in the upper beds

* During the autumn of 1834, they literally swarmed in apartments, even in the immediate environs of London.

of the chalk, although they are now very rarely found in the quarries in that neighbourhood.

CHOCOLATE NUT is the *Theobroma cacao* of Linnæus. See THEOBROMA.

CHOLEVA (Latreille). A genus of coleopterous insects, belonging to the section *Pentamera*, and family *Silphidæ*. This genus, together with those of *Catops*, *Pltomaphagus* and *Mylæchus*, form a small group, distinguished by their small size, and great agility; the antennæ with the club five-jointed, the eighth joint being very minute, and the elytra rounded at the tips. Mr. Spence has published a monograph upon the group in the Linnæan Transactions. The insects are of dark and obscure colours, frequenting dry bones, putrid fungi, and vegetable matter in a state of decay. There are numerous British species.

CHOMELIA (Jacquin). West Indian shrubs, formerly called *Ixora* by Lambert and Swartz. Linnæan class and order, *Tetrandria Monogynia*; natural order, *Rubiaceæ*. Generic character: calyx tubular, limb four-cleft, recurved; corolla tube long, cylindrical, limb in four divisions, spreading points of the divisions acute; stamens with short filaments inserted in the tube; anthers linear, and somewhat prominent; style filiform; stigma in two spreading processes; drupe oval, containing a four-furrowed two-celled nut, each cell one-seeded. This genus being nearly allied to the *ixoras*, also partakes of their ornamental character.

CHORAGUS (Kirby). A minute genus of British coleopterous insects, of whose family entomologists are at variance. It is of an ovate form, with the head deflexed, the antennæ long and terminated by a club; the legs are short and of a moderate thickness, nevertheless the insect possesses the power of leaping in a remarkable degree. Mr. Kirby, by whom it was first described, thought it allied both to *Cryptocephalus* (from the length of the antennæ and form of the body), and *Cis* (from the former being clubbed). Mr. Stephens places it amongst the *Ptinidæ*, whilst M. Robert has recently figured it as an *Anthrabus*, a genus allied to the *Bruchidæ*. It is found amongst grass and low herbage, but is very rare.

CHORIZEMA (Labillardiere). A genus of beautiful shrubs, natives of New Holland. Linnæan class and order, *Decandria Monogynia*; natural order, *Leguminosæ*. Generic character: calyx two-lipped, upper one cleft, lower one trifid; corolla keel bellying, wings short, style short; pod swollen, many-seeded, nearly sitting. These are extremely neat greenhouse plants. The *C. Henchmannii* deserves a place in every collection. They are propagated by cuttings.

CHRISTMAS ROSE is the *Helleborus niger* of Linnæus. One of a herbaceous family of plants indigenous to Europe, and long introduced into gardens on account of their early flowering. The whole of the hellebores are said to contain poisonous principles in a greater or less degree, though some of them are very fragrant. The flowers generally appear before the leaves, and are some of the first gems of the spring. They are propagated either by dividing the root or by seeds.

CHRIST'S THORN is the *Zyziphus spina Christi* of Willdenow. It is a native of Egypt, and is cultivated in our greenhouses, and easily increased by cuttings.

CHROMIS. A genus of spinous-finned fishes

belonging to the family *Labroides*. Their general characters are: their lips and intermaxillary bones contracted; a single dorsal fin with two produced filaments, teeth set like those of a card on the jaw bones and the palate, their lateral ones intercepted, the ventral fins produced in long threads. There are numerous species, several of which are occasionally found in the British seas. They are not of large size, but they are esteemed as food. For some detail of them, the reader is referred to the article LABROIDES.

CHONDROPTERYGII (CARTILAGINOUS FISHES). An order or rather sub-class of fishes which differ so very much in many of their essential characters from the rest of the finny tribes, that naturalists have sometimes described them under the name of reptiles rather than fishes. But still, how much soever they may differ from the other inhabitants of the waters, they are decidedly fishes, only it is not easy to trace a gradation either from them to the others, or from the others to them. In some parts of their organisation they are no doubt inferior to the bony fishes, but there are some others in which they are decidedly superior.

They differ greatly in the several divisions of the sub-class; but they all possess that general cartilaginous texture of the bones, on account of which the name has been given them. This character varies much however in the different genera, so that it is not possible to frame a general description, so that it shall be strictly applicable to any one species. In general, we may say that they have some resemblance to that division of the soft-finned fishes, to which Cuvier very accurately applies the name of *plectognathes* or "soldered jaws"—because these fishes have the bones of the mouth united to each other, and consequently comparatively little motion of that organ. There is another approximation in that family to the sub-class now under consideration, namely, a tendency to produce upon the skin, not scales as in the other bony fishes, but grains or tubercles of osseous matter.

The chondropterygii have all the bones, forming the cranium or cavity containing the brain, united into a single piece, but still there are markings which indicate portions resembling those that are united by sutures in other fishes, though in some these markings are almost entirely obliterated, and the whole skull consists of one case of flexible bone. The vertebral column may be said generally to consist of one single flexible piece, though in this also there are differences, some having articulations marked throughout its length, and even tolerably distinct apart, while in others, as in some of the *cyclostoma*, "round mouths," or suckers, there is scarcely any indication of a joint even by a simple marking; so that these may be regarded as, in their skeleton at least, being at the very bottom of the scale of vertebrated animals, and connecting them with some of the most simply formed tribes in the whole animal kingdom, the *myxine* or hag being as much like a slug or leech as a fish, although it has still the general character and economy of a vertebrated animal.

But it is in the general texture of the bone, rather than its form, that the distinguishing character of these fishes consists. In all other vertebrated animals the bones are made up of plates, and these plates of fibres, which extend in the direction of the length of the bone, so that the bone is much more easily split in length than broken across, whereas in the chon-

dropterygii, whatever of osseous matter, or earthy salts, is formed in the cartilaginous matter, forms in grains, which are detached from each other without any appearance of being organised in any direction.

The bones, even of those animals which have the skeleton hardest and most perfect when mature, are cartilaginous when they are young, and they ossify gradually, requiring a longer or shorter time in different races of animals; but, when ossification begins, always begins at points, and proceeds from those points as centres, in lines of definite arrangement, the characters of which are worthy of more attention than they have hitherto received. Thus there is in the cartilage of these animals, a principle by means of which it can organise the earthy parts of the bone, as well as produce them, whereas, in the fishes under consideration, this principle seems to be entirely wanting; and therefore, though the general cartilaginous basis of the bone may be considered as a product of organisation, the hard matter which may afterwards be imbedded in it, is not so imbedded in consequence of any particular law of organisation. In this respect therefore, we may with perfect correctness say, that these fishes are a stage lower in the structure of their bones than any other vertebrated animals. It seems also that their cartilage is differently formed. The cartilage of the others is to a considerable extent fibrous, though the fibres are not easily perceptible, in consequence of the closeness of their union; and we may suppose that the reason why the bony matter in this sub-class of fishes is not organically arranged, is the absence of this structure in the cartilaginous basis. Therefore, though the term "cartilaginous" answers very well for distinguishing them from other fishes, we must not suppose that they have the same kind of cartilage as the others only without the bony matter in it; for their cartilage is not only really but necessarily different. If it were the same in substance and in arrangement, it would be impossible not to suppose that it would ultimately ossify into the very same kind of bone. If we were not to conclude that the same preparing substance would, and must, under the same circumstances, produce the very same result, then we could come to no conclusion whatever, and there would be an end to natural history as a science.

Imperfect as the bony structure of these fishes thus seems, it has its advantages. They move more freely than animals with stiff bones; they are much less liable to injury; and so far as we know, they are exempted from old age, from decay, and probably from death, except by casualty.

In all cases where the bones of the vertebral column are stiff, the motion of the joints is confined to certain directions only; and though some vertebrated portions, as in the necks of many birds, and more especially in the *chelonians*, which have hard shells, have very beautifully formed joints, and admit of a wonderful degree of flexure, yet in them the flexure is produced by every different joint being bent in a different direction, there being as many centres of motion as there are joints, and consequently a very complicated apparatus of muscles for moving them. The bones of the true serpents (we are of course speaking of the vertebral column only), and those of bony fishes, afford instances of motion which is more free and more general in its direction; but still the principal motion is referable to a definite plane in the body of the animal. That of the serpents is

vertical, passing through the middle of the back and the belly, and there is generally a distinct mesial line along one or both. The bony fishes again are articulated, so as to have their principal motion in the horizontal plane passing through the middle of the sides, which are generally marked by lateral lines. The joints in these are without processes, upon which a particular motion can be performed as on a centre, for they consist of two hollow conical cups, with their lips applied to each other, and their cavities filled with cartilaginous substance, so that each of them may be considered more or less as a universal joint, though this is modified in different species, in such a manner as best adapts them to their habits; a bone of this kind is obedient to the action of the general muscular mass in which it is embodied, and does not need detached muscles for the motion of every single joint, attached at each extremity to one of the bones which meet at the joint, in the same manner as in animals which have the bones articulated upon each other by means of processes and cavities. The muscles of fishes act between the bone and the skin, as their two principal points of insertion; and as the skin is supported externally by the weight of the element in which the fish moves, much less muscular exertion is required to produce motion, than in animals which have the bones with regular joints.

In the cartilaginous fishes, this facility of motion is communicated to the whole of the vertebral column, so that they can move with still less of muscular effort than the true fishes. Thus they have great command of themselves in the water, without much exhaustion of their system; and as there is at the same time no positive limit to the growth of their bones, they are exempted from old age and decay.

This leads us to another peculiarity of their structure, their respiratory system. The quantity is proportionately less than that of bony fishes, and their breathing apparatus is of more simple structure. In consequence of this, the whole functions of life in them are carried on with less exhaustion of the system than those of the other fishes; and thus, while their body is less worn by the operation of living, it requires less renovation, the principle of life in it is more durable, they can bear abstinence for a greater length of time, can feed more voraciously when they do feed, and more of the substance of their food can go to the increase of their size. These particulars vary much in the different divisions or orders into which they may be divided, and also in the subdivisions, but still they, to some extent, apply to the whole.

There is this further to be remarked on them generally, that their organs and manner of reproduction are much more perfect than those of the other fishes, that in these respects they bear a considerable resemblance to reptiles; and some of them have even a physiological, though not a structural, resemblance to the marsupial mammalia. In describing them according to their feeding apparatus, which, however, is much less satisfactory in the case of fishes than in that of any other vertebrated animals, the most remarkable circumstances are the absence of maxillary and intermaxillary bones for supporting the teeth. But the teeth, though they are without bony supports, are not the less powerful; for some of these fishes, as the shark for instance, have more formidable mouths than any other animals. The teeth are

moveable; and as they are generally in several rows, they can hold on with one part, and cut and tear with another; and if we except those fishes which feed upon crustacea or sea-weed, they are perhaps the only ones which divide their food by the action of the mouth.

The skin is a very important part of the structure of these fishes, and may be said to contribute almost as much to support them in their motions as the bony part of their structure. Indeed the skin is almost the only part in which any substance approaching to the character of bone is formed. Some of them produce large plates as in the sturgeons (see the article *ACCIPENSER*), others hooks and spines, some of which are very formidable weapons, and others tubercles of various forms and sizes. The various species of shagreen which is used for covering boxes and various other articles are the skins of sharks. These bony appendages are exceedingly hard in their consistency; but whatever may be their form, they partake of the general character, which we have already alluded to as distinguishing the internal bones—they do not exhibit a fibrous structure, but are uniform throughout; and though it is difficult to divide them in any particular direction, they are equally divisible in all. These fishes are divided into two sub-orders, those which have the gills fixed, and those which have the gills free.

WITH FIXED GILLS. In these the gills adhere to the skin, or rather to the integument of the sac in which they are contained, instead of being loose at their posterior edges, as is the case with other fishes. The water does not therefore pass through the gills of these fishes as it does through those of others; neither have they any gill-lid, or *operculum*, by the action of which they carry on the operation of breathing. They have between every two fringes or leaves of the gills, an opening for the admission of water, and the outer edge of each gill is supported by a cartilaginous arch imbedded in the flesh, between the openings; and it is by means of the muscles acting on this arch, that the process of breathing, which is a very slow one, is carried on. The genera and species of this order are much more numerous than those with free gills. They consist of two families, *PLAGIOSTOMUS*, "oblique mouth," or "cross mouth," the mouth being in the form of a slit under the snout, which generally projects a considerable way in front of the opening, and the mouth, from the absence of jaw-bones, admits of a great deal of motion; and *CYCLOSTOMUS*, "round mouth," from the mouth being in the form of a sucker, or capable of turning backwards so as to be on the same plane all round. Some notice of each of these families will be given under its name in the order of the alphabet.

WITH FREE GILLS. These have their gills free at the one extremity, as is the case in ordinary fishes, and they have only a single gill opening, for allowing the water to escape. This opening is furnished with a gill lid; but without any flap. This sub-order consists of four genera, though all these may be included in one family, the sturgeon family. See *STURIONIDÆ*.

Of these two orders or sub-orders, those with fixed gills may be considered as the most typical; but both stand so distinct from the rest of fishes, that, with the exception of the partial resemblance to *plectognathes* above alluded to, they must be considered as forming, not a subdivision of fishes considered as one class of animals, but as a distinct class of fishes, which

hold a very peculiar place in the structural system of animals, and also from their numbers perform an important part in the living economy of the waters.

We must not suppose that there is any thing out of nature, in there thus being two distinct classes of vertebrated inhabitants of the waters, any more than that there should be different species; for we have a similar division of mammalia; the marsupial animals being as distinct from the other mammalia, as the chondropterygii are from the other fishes. We have mentioned that there are some points of relation between those second classes of mammalia and of fishes, and one would be almost led to believe that they are portions of a different creation from the other classes, which they resemble in their common economy and habits. It is exceedingly difficult, however, to trace the analogies between sea and land animals, not only from the great ignorance in which we must for ever remain as to the details of what goes on in the deep, but because many links in the chain are wanting.

CHRYsalis or AURELIA. Under these terms is designated the pupa state of lepidopterous insects. Having already, in our article *AURELIA*, given some account of the cause of the application of these terms to this state, and in one article, *BUTTERFLY*, detailed the peculiarities of the chrysalides of the *Papilionidæ*, we shall here briefly notice some general circumstances relative to chrysalides in general, and to those of moths and hawk-moths in particular, reserving to the article *COCOON* our account of the construction of those curious envelopes in which the insect is often in this state inclosed.

The pupæ of lepidopterous insects entirely differ from those of every other order of insects, a circumstance of some interest as well as peculiarity, since in other instances we find the pupæ of several orders exhibiting the same general form. In the *Lepidoptera*, however, the various organs of motion of the future insect are laid along the breast and sides, but are folded up under a hard skin, whence they are much less distinctly perceptible than in the pupæ of other insects. Linnæus has termed this an obfuscated pupa. In general lepidopterous chrysalides are of an oblong-oval form, obtuse at the head, and gradually becoming narrow towards the tail; but in some moths, as in the *Bombyx luna*, the form is shorter, and obtuse at each end. Under this form the insect appears neither to have legs nor wings, it seems even destitute of life, taking no nourishment and appearing like an unorganised mass, the only sign of life being a slight occasional twitching of the hind part of the body. The outer covering appears of a cartilaginous nature; it is commonly smooth, but in some few instances it is hairy. From the blunt extremity of the body are to be observed various small and narrow compartments, arranged like the bands of a mummy. These are the coverings of the legs and antennæ, disposed along the breast, the part from whence they seem to arise is the head, which is covered by a piece termed the *Cephalotheca*. On the outside of these narrow bands are to be observed two broader scales, which, covering the wings, are termed *Pterotheca*, arising from the opposite side to the breast, and which is the covering of the thorax, or *Cylotheca*. This is followed by the abdomen-case, *Gastrotheca*.

The chrysalis, upon quitting the exuvia of the caterpillar, is soft and tender; by degrees, however,

its external envelope becomes hard and friable. Moreover the surface of the body is at first moistened with a viscid fluid which exudes from beneath the wings, and the other parts which are inclosed between these organs, and which becomes thickened and hardens rapidly, and in so doing glues together the contiguous parts, which are consequently now inclosed in an additional envelope, this taking place within twenty-four hours after the change; at the same time also this fluid not only loses its transparency, but also acquires a colour. Previous to the hardening of this fluid it is easy to observe as well as to separate the various external organs of which the future butterfly is composed, as the antennæ, legs, wings, &c. There is this difference, however, between the chrysalis and the imago, at least of the butterflies; in the former state one pair of wings, the upper, are alone to be observed, the second, or inferior pair, being hidden beneath them, the intermediate space in the pupa being filled with this gummy matter, by which they are at length glued together; whereas in the butterfly (but not in the moths, except during flight) the lower pair of wings are exposed, even when the butterfly is at rest upon the bosom of a flower.

Reaumur has divided chrysalides in general into two great divisions, namely, those which, from having various angular projections upon the body, he has termed angular chrysalides, and those in which the body is smooth and unfurnished with these projections, and which may be termed conical chrysalides, but which Reaumur calls "feves;" and it is a curious circumstance, that all angulated chrysalides produce butterflies, whilst from the conical chrysalides, with a few exceptions, the various tribes of moths and hawk-moths are produced; these exceptions being confined to the small butterflies, belonging to the family *Lycænidæ*. Moreover the chrysalis of the orange-tip butterfly (*Mancipium cardamines*) seems intermediate between the two groups, having the body boat-shaped, with a spindle-formed process arising from the head, as well as the tail. There is a great difference in the situation of the prominences and angulated projections, upon the body of the chrysalides belonging to the first of these divisions, and in some of the old works of natural history, we find the representations of them fancifully converted into the singular profile of the human face, the dorsal prominence forming the nose! Amongst the conical chrysalides, there are also various differences to be observed; we shall, however, only notice those offered by the sphinx family, in which the tongue, which in the perfect state is exceedingly long, is inclosed in a thickened cylindric proboscis, which stands off from the breast, and within which the tongue is curled up; whilst, in the genus *Calophosia*, Stephens, a provision of a different kind is made for the unusual length of the organ, by the tongue-case being recurved upon the breast, in which respect it approaches the hawk moths, *Cucullia*.

In our article BUTTERFLY, we have alluded to the incorrectness of the fanciful notions entertained by the old naturalists, that insects in their progress to the perfect state underwent a series of real metamorphoses. In like manner we may notice, as conveying an equally incorrect idea, that the bursting forth of the butterfly has been adopted as an illustration, fitting to convey a token of one of the profoundest mysteries of our Holy Religion.

Oh, start not! on thy closing eyes
Another day shall still unfold,
A sun of milder radiance rise;
A happier age of joys unfold.
Shall the poor worm that shocks thy sight,
The humblest form in nature's train;
Thus rise in new-born lustre bright,
And yet the emblem teach in vain?

The idea is highly poetical, but the simile is not correct when the changes undergone by "the poor worm" have had all of the marvellous stripped from them by the assistance of direct observation; and yet these changes are not, on that account, the less wonderful. To them, indeed, may well be applied the celebrated words of the poet—"Truth is stranger than fiction."

The body of the caterpillar consists of twelve segments, exclusive of the head and anus, and on each side of the 1st, 4th, 5th, 6th, 7th, 8th, 9th, 10th, and 11th of these segments, a small oval spiracle or breathing pore is to be observed, making together eighteen. In the pupa, notwithstanding the great alteration which has taken place in the size and disposition of the segments, we notice, besides the head, first, a small, nearly square, piece, being the remains of the first segment, having, on each side, a small breathing pore; next, a large dorsal piece, giving rise to the large anterior wings, which is the second segment; then a short dorsal piece, giving rise to the second wings, being the third segment; after which, follows another short segment, of which the spiracles are not observable, which is succeeded by seven spiraculariferous rings; then comes another ring, without spiracles, and the body is terminated by a plate covering the anal organs. This description is taken from a living male Chrysalis, of the splendid large Emperor moth, *Pavonia major*, an inhabitant of France.

The *Chrysalides* of various moths exhibit a singular circumstance not hitherto satisfactorily accounted for, but which present an interesting instance of that parental care, "which nature so conspicuously manifests towards the most insignificant (if any can be called such) of her productions." The small Eggar moth, *Eriogaster lanestris*, is one of the most remarkable of these species,—doomed to a regular appearance, in the winged state, at the termination of the cold and ungenial month of February, nature (that it may not fail and become extinct) reserves a small portion of it annually, in the pupa state, until the February following that of its pupation, and sometimes even until the third occurrence of that frigid month, denying their emancipation all the intermediate time, and thus effectually securing, by these unusual means, the safety and perpetuation of an animal, small it is true, but whose annual existence, at that inclement season, in the winged state, is probably of more consequence in the intricacy of its great Creator's plans than we are at present aware of, although He constantly exposes it to the dangerous vicissitudes of winter; for

Each shell, each crawling insect, holds a rank,
Important in the plan of Him who framed
This scale of beings, holds a rank, which lost,
Would break the chain, and leave behind a gap,
Which nature's self would rue."—*Lepidoptera Britannica*.

CHRYSA N T H E M U M (Linnæus). An extensive genus of herbaceous perennial and annual plants, valued for their large showy flowers. Linnæan class and order, *Syngenesia superflua*; natural order, *Com-*

positæ. Generic character: anthodium hemispherical, scaly; scales with scarious margins; receptacle plain and naked; seeds oblong and angular. The geographical distribution of this genus extends over all the northern hemisphere, from the British isles to Kamschatka, and from Siberia to Asia Minor. One of the British species, *C. segetum*, was formerly a troublesome weed in corn, insomuch that land subject to it was lower rented than that where the yellow weed was unknown. By careful hand-weeding, however, the plant is now almost banished from all well cultivated fields. Several are admitted into the flower garden; and since the introduction of the Chinese half shrubby species, every greenhouse, garden, and court-yard, are ornamented with them. Few plants have engaged the attention of florists more than this, and they are now as much admired, and as much cultivated in England, as they are in China. Two monographs have been published of the *C. Sinense*, the first by J. Sabine, Esq., S.H.S. of London, and the second by the late A. H. Haworth, Esq. According to Mr. H., there are above fifty different species or varieties, all of them handsome, and some of them splendid flowering plants. They are what are called *half-hardy*, that is, if planted in the open ground, their stems, like those of other perennials, are killed down to the ground in winter; but the aggregated roots survive with but a very slight protection, whence the flowering stems of the next summer are produced.

There are various methods of cultivating the chrysanthemum. The easiest, perhaps, is to plant them close under a wall, to which the stems are trained during their growth. They may also be planted singly in the flower borders, and the shoots kept tied to a stake as they advance in height. But, as the plants flower very late in the season, a circumstance for which they are much prized, they require assistance from heat, either reflected from a wall, or applied in some other way, in order that the flowers may be sufficiently forward to blow before the frosts set in.

Young shoots separated from the old stool, or cuttings made of the earliest shoots, are soon established as individuals, and in this state grow much more luxuriantly than if they had been left on the parent stool. These young individuals, being more robust in habit, produce larger flowers, and these in greater abundance.

As the flowers are terminal, that is, produced on the points of the shoots, they cannot appear until the stem has gained its full height, which is sometimes, when trained to a wall, six or eight feet; and when allowed to grow so tall, and kept in pots, are very inconvenient in a greenhouse. To counteract this tendency to run up, and to have low bushy plants and a plentiful bloom, a judicious practice has been had recourse to by some florists with the best effect. This is by layering the strongest shoots, in the months of June and July, into pots of light rich compost, plunged in the ground at a proper distance round the stool, and in a shady place. The point of the layered shoot is thus furnished with a new system of active roots, which are competent to perfect the further elongation of the shoot, with its terminal bouquet of flowers; and these, though quite perfect as to form and colours, are never quite so large as would have been borne by the shoot if it had not been layered at all. Each stem bears a branched head of

flowers; and if a few only are wished to be as large as possible, they may be thinned by cutting off all the inferiors before they are too far advanced.

There are other ways of dwarfing the chrysanthemum besides layering them as above described. Starving them in poor sandy soil, in diminutive pots, and allowing but short supplies of water, will check luxuriance; but this is always at the expense of the beauty and size of the flowers.

CHRYSIDIDÆ (Leach). A family of hymenopterous insects, belonging to the section *Pupivora*, and distinguished, not only by the exceeding brilliancy of the colours of the insects of which it is composed (whence the origin of the name which signifies golden flies), but also by the antennæ having thirteen joints in both sexes, the basal joint being the longest, so as to form, at its extremity, an elbow with the remaining joints; the mandibles are narrow, curved, and pointed; the lower wings are destitute of nervures, and the abdomen of the females is terminated by an articulated retractile ovipositor, composed of several of the apical segments of the body, the abdomen itself appearing to be composed of only three or four segments. The under surface of this part of the body is concave; so then, when the insect is alarmed, it contracts itself into a ball, like a wood louse, leaving the wings only exposed. These insects are adorned with the richest colours, the thorax being generally of a fine blue colour, and the abdomen of a polished coppery flame colour; they fly, in the hottest sunshine, about old walls and palings exposed to the sun, with very great agility, seeking entrance into the burrows of other insects, in the nests of which they deposit their own eggs, in the manner of the cuckoo-bees. See *Cuculinæ*. M. St. Fargeau has observed the proceedings of the female of the species *Hedychrum regium*, which, in general, selects the nests of *Megachile muraria*, a wild mason bee. Having entered one of the nests of this bee, head foremost, it drew back and turned itself round for the purpose of introducing the hind part of its body into the nest, walking backwards. The bee, however, arrived at this critical juncture with a supply of pollen paste, no sooner, however, did she perceive her enemy than she pounced on it and seized it with her jaws; like the *Chrysididæ* in general, however, it immediately rolled itself into a ball, so that the jaws of the bee, although very powerful, were not able to affect the least wound upon the polished cuirass of the *Hedychrum*; she, however, cut off the four wings of the latter which were undefended, and then let it fall to the ground. She then visited her cell with some inquietude, deposited her store of provision, and returned to the fields for a further supply. No sooner, however, was she gone than the *Hedychrum*, which had, during the interval, remained rolled up, unrolled itself, crept up the wall, and quietly deposited its eggs in the cell, from which it had just previously been precipitated, placing them in the midst of the paste against the walls of the cell, which prevented the *Megachile* from perceiving it.

De Geer found the *Chrysis micans*, in the resinous gall of the pine, whence he surmised that its larva had been nourished upon the larva which had been previously inclosed therein, having observed at the bottom of the cell of the gall, an empty cocoon, composed of loose silk, which the *Chrysis* had pierced in order to make its escape.

This family comprises the genera *Parnopes*, *Chrysis*, *Stilbum*, *Euchræus*, *Pyria*, *Hedychrum*, *Elampus*, and

Cleptes. The genus *Chrysis* has the mandibles with one small tooth, the labium rounded and entire, the maxillary palpi much longer than the labial, and the thorax not narrowed in front.

There are about thirty-five species of this beautiful family found in this country, two-thirds of which belong to the last mentioned genus, of which the *Chrysis ignita* of Linnæus is the type.

CHRYSHIPHALA (Ker). A Peruvian family of bulbous herbs, introduced within the last fifteen years. Linnæan class and order, *Hexandria Monogynia*; natural order, *Amaryllideæ*. Generic character: perianth tubular, tube contracted in the middle, limb erect, and expanded like a funnel in six divisions; corolla shortened interiorly, toothed, and bearing the stamens; filaments awl-shaped and erect; anthers incumbent; style thickly spindle-shaped below; stigma club-shaped; capsule three-celled, three-valved, and many-seeded. This genus was called *Stenomison* by Herbert, and *Pancratium* by Ruiz and Pavon.

CHRYSOBALANEÆ. The cocoa-plum family. A natural order of dicotyledonous plants, containing nine genera and upwards of thirty known species. By some botanists the order is considered as a section of *Rosaceæ*, to which it is undoubtedly allied. It has also an obvious affinity to *Amygdaleæ*, but differs in having irregular petals and stamens, and a style proceeding from the base of the ovary. By the former of these characters, as well as by the cohesion which exists between the ovary and the calyx, the order may be said to approach *Leguminosæ*, but the position of the styles and ovula, and the relation which the odd lobes of the calyx bear to the axis of inflorescence, are sufficient to distinguish the two orders.

The following are the botanical characters of *Chrysobalanææ*: calyx five-lobed; petals more or less irregular, either five or none; stamens definite or indefinite, irregular in size or position; ovary solitary, free, its stalk cohering on one side to the tube of the calyx; ovules two, erect; style single, arising from the base; stigma simple; fruit, a drupe one or two-celled; seeds usually solitary, erect; embryo with fleshy cotyledons, and no albumen.

The plants referred to this order are trees or shrubs, with simple alternate stipulate leaves, and flowers in racemes, panicles, or corymbs. They grow in tropical countries, and are found chiefly in the warm regions of Africa and America. A few species are supposed to exist in Equinoctial Asia, and one is said to be found as far north as the pine-barrens of Georgia, in America. In the latter country, however, it is to be remarked, that the climate is much warmer than in most countries lying in the same parallel of latitude. The order furnishes some esculent fruits, but none of the plants appear to be possessed of any particular medicinal properties. The genera are, *Chrysobalanus*, *Moquilia*, *Corcepia*, *Acioa*, *Parinarium*, *Grangeria*, *Licania*, *Thelyra*, and *Hirtella*.

Chrysobalanus Icaco is an irregular shrub, eight or ten feet high, which grows in South America and in the West Indies, in situations not far from the sea. It bears small whitish flowers, and yields a fruit the size of a plum, which is sometimes of a white, at other times of a yellow, red, or purple colour, and is eaten in the West Indies under the name of cocoa-plum. It has little odour, and a sweetish taste. The

root of the plant is astringent, and has been used as such medicinally. *Chrysobalanus luteus* resembles the lemon-tree, and is found in the maritime parts of Sierra Leone. It yields an esculent fruit the size of a plum, which is sold in the markets.

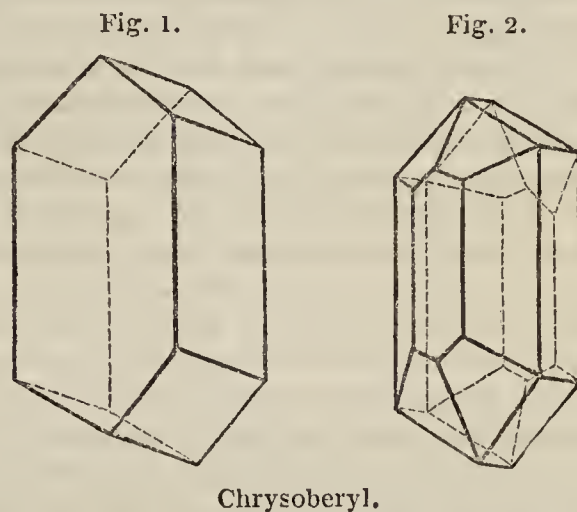
Parinarium excelsum, found on the mountains of Sierra Leone, supplies an insipid fruit, eaten by the negroes under the name of the rough-skinned or grey plum. The kernel of the fruit of *P. campestre* and *montanum* is said to be sweet and edible.

Grangeria Bourbonia is a tree the size of an oak, with entire leaves and small flowers, found on the Isle of Bourbon.

Hirtella Americana. A tree twenty-five feet high found in Cayenne and Guiana, is furnished with a reddish bark, and has its branches covered with fine hair. Some of the species of this genus are tall trees of the tropics, which support themselves on other plants.

CHRYSOBALANUS (Linnæus). This is a West Indian fruit tree, called the cocoa-plum. It belongs to the class *Icosandria Di Pentagynia*, and to the natural order *Rosaceæ*.

CHRYSOBERYL. A very beautiful mineral, of a yellowish-green tint, which derives its name from a Greek word, indicative of its peculiar hue. It sometimes exhibits a milk-white opalescence, which appears in general to radiate from the interior of the mineral, and reflects much light. It is seldom found crystallised; but the primitive form is a prism of $104^{\circ} 41'$. The most frequent secondary forms are those



in the accompanying figures. Fig. 1, is a short and broad six-sided prism, or thick table; fig. 2, a very short and broad six-sided prism, acuminate on both ends with six planes, set on the lateral planes, and the orifices truncated.

This mineral occurs in Brazil, in alluvial soil with the topaz, or in sand-stone with the diamond. Some are also procured from the United States. The beds of the rivers in Ceylon occasionally present this mineral; it is there sometimes found in conjunction with sapphires, rubies, and tourmalines. The finest specimens of the chrysoberyl employed in this country for the purposes of the jeweller, are those imported from South America.

CHRYSOCHLORIS—Golden-green Mole. A genus of carnivorous mammalia, belonging to the division which feed on insects. The generic characters are: two incisive teeth in the upper jaw and four in the under, the cheek teeth stand high, are separate from each other, and have the form of triangular prisms. Their muzzle is short and turned up; their fore feet have only three claws, of which the exterior one is

very large, pointed, and crooked, and serves them for digging their way rapidly under ground; the hind feet have five claws on each, which are of moderate size. Their habits are similar to those of the common mole; but their organisation is very different. The clavicle is much more slender than in the mole, while the first rib is on the contrary much thicker and very long. The blade bone is also large, and the humerus is nearly three times the length of that of the mole. The fore arm is also supported by an additional bone. Indeed there is no animal in which the shoulder is better articulated for powerful motion than in this genus, small as are the animals. There is but one species which is well established, the golden mole of Southern Africa (*C. Capensis*), but this one has occasioned no small trouble to those naturalists who make colour a principal character, and describe animals from museum specimens.

This species is a very small animal, considerably less than the common mole of Europe; in consequence of its subterraneous habits it is not very frequently seen; and in respect of colour it is as perplexing as theameleon. We believe that the real colour, that is the colour as seen in light which is not refracted, is brown; but, different from all other mammalia, this small animal has the same metallic reflections in its fur which are observable in the feathers of many birds, the range of these colours being from a deep golden yellow, or rather a sort of bronze red, to a bronze green; and as all animals which have the metallic reflections lose them when dead and dried, the stuffed skin of this one conveys no idea of what the living animal is like. Hence it has been described as if of different colours, and has been attributed to different parts of the world, as to America and Siberia. There are many districts of these parts of the world which are still very imperfectly known, and the habits of those small burrowing mammalia render it very difficult to ascertain what are their numbers; and therefore the subject is one upon which mistakes are unavoidable, as there may be many species in those unexplored countries of which no individual has been seen. This animal has no apparent tail, no external concha to its ears, and no visible eyes, until they are forced open by direct experiment. Its snout is formed with a moveable cartilaginous rim, and by means of this and its powerful fore-paws it gets along the ground with considerable celerity. In Southern Africa it is nearly as troublesome in rooting up gardens with its subterranean passages as the common mole is with us. Its time and manner of breeding, and its general habits, farther than that it is a dweller in the earth, are little known; but it is ascertained that the female has two mammæ situated in the groin.

This species has sometimes been confounded with those animals which are properly styled rat-moles on account of their having the habits of moles, at least in so far as burrowing is concerned, while they are rodent or gnawing animals in their general structure. Those which have this compound character may be considered as in so far omnivorous, eating indiscriminately small animals and succulent vegetable matter, whereas the cheek teeth of this genus are wholly or chiefly of an insectivorous character; and therefore it only disfigures those grounds in which it makes its runs, and does not eat the fibres of vegetable roots. Though a small and obscure animal, this is remarkable for its beauty, if it were possible to preserve that beauty in the dried skin. Its colours have already

been mentioned, and we may add that the texture of its fur is more delicately soft, and also more beautiful in its lustre than that of the mole. It is worthy of remark, that these small burrowing animals are neither soiled by mud nor readily wetted by water.

CHRYSOCOLLA. A genus of molluscs established by De Montfort, but united with the genus *Polystomella*, of which it forms one of the divisions.

CHRYSOCOMA (Linnæus). A genus of yellow flowering shrubs from the Cape of Good Hope, and herbs, natives of Europe and North America. These plants are the goldyllocks of our gardens, and belong to the natural order *Compositæ*, propagated by cuttings and division of the root.

CHRYSLITE. This mineral is characterised by its pistachio green colour. It is brought to Europe from the Levant, and is said to occur in upper Egypt, on the shores of the Red Sea, and in the Isle of Bourbon. The chrysolite has a considerable degree of lustre and transparency; but it is one of the softest of the precious stones, hence jewels of it become dull on the surface, if the slightest attrition be employed.

CHRYSOMELIDÆ (Leach). A very extensive family of coleopterous insects, belonging to the section *Tetramera*, and sub-section *Cyclica* of Latreille, which latter group is almost identical with the Linnæan genus *Chrysomela*, but which, from the amazing number of additions made thereto since the days of the great Swede, it has been considered necessary to separate into three divisions, namely, the *Galerucidæ* (*Galerucitæ*, Latreille); *Chrysomelidæ* (*Chrysomélines*, Latreille); and *Cassididæ* (*Cassidariæ*, Latreille. See *CASSIDA*). These groups are conjointly characterised by having the body of a small or but moderate size, and of an oval or rounded form, being seldom elongated. The antennæ are seldom so long as the body, and filiform or gradually thickened towards the tips; the thorax is sometimes as wide behind as the base of the elytra; the three basal joints of the tarsi are dilated and spongy beneath, forming a kind of cushion; the legs are of a moderate length, but rather thickened, especially in the part termed the femur or thigh, which in the hind legs is sometimes greatly incrassated, as in the turnip beetles (*Halticæ*) and some others. Generally speaking, these insects are of sluggish habits, frequenting plants and vegetables, upon the leaves of which they feed both in the perfect and larva state; being during the latter period of their lives of a soft fleshy consistence, with six legs, and emitting a viscid secretion, which serves to affix them to the objects upon which they are placed. It is here also they are transformed into pupæ, the posterior part of the body being affixed to the leaves, &c., and surrounded by the cast skin of the larva. In both these preparatory stages, the body of the insect is ornamented with various colours, and in the perfect state we find nearly the whole group distinguished by their highly polished and metallic tints, whence the origin of their name, which signifies golden beetles. When disturbed, they immediately fall to the ground, folding their legs and antennæ along the sides of the body. It is, however, in tropical climates, where vegetation reaches its greatest luxuriance, that these herbivorous insects abound; and to so great an extent, that from the state of our collections, we should feel inclined to average the Linnæan chrysomelæ at, at least, one-eighth of the whole order of beetles.

Latreille has arranged the groups of which this division (*Cyclica*) is composed, from a consideration of the various habits of the larvæ, as follows:—1st, those which cover themselves with their own excrements (*Cassidæ*). 2nd, those which reside in portable cases (*Clythra*, &c.). 3rd, naked larvæ. 4th, larvæ living in the interior of leaves, feeding upon the parenchyma (*Haltica*): but it is to be borne in mind, that this mode of distribution must be cautiously regarded, since the *Galerucidæ*, to which the *Halticæ* are referable, are naked, and it is by no means decided that the larvæ of the latter are internal feeders.

The three divisions or families above mentioned, may be readily distinguished by the following characters:—

1. *Cassididæ*. Antennæ arising close together, concealed at the base by the thorax.

2. *Chrysomelidæ*. Antennæ remote from each other at the base.

3. *Galeracidæ*. Antennæ close together at the base, and not concealed by the thorax.

The family *Chrysomelidæ* have the body oval, more or less tending to a globular or an oblong shape; the antennæ are generally slightly thickened towards the tips, and the legs are nearly of an equal size. These beetles, notwithstanding their small or but moderate size, are amongst the most beautiful of coleopterous insects; they are highly polished, and their colours are greatly variegated, green and gold, blue, purple, and crimson, being very conspicuous in the majority. Some of the species are social, as that found upon the leaves of the willow (*C. vitellinæ*), the larvæ of which feed in regular rows along the leaves. These larvæ have the body thick and fleshy, and terminated by a fleshy tubercle, which is employed as an additional seventh leg. The larvæ of one of the largest British species (*C. populi*), emits a disagreeable scent, a yellow oily fluid being discharged from the limbs when the insect is disturbed. Some of the larvæ undergo their transformations under ground. The pupæ, which does not present any peculiar characters, is of an oval form, and affixed by its posterior extremity to the leaves, the perfect insect making its appearance at the end of several weeks, or occasionally in a few days.

The family comprises two very distinct sections. 1st. Those having the head but slightly deflexed and exposed to view, the antennæ seldom exceeding half the length of the body, and slightly thickened to the tips, with the body of an oval form. Here belong the genera *Phædon*, *Melasoma*, *Chrysomela*, *Helodes*, and *Timarcha*, all of which are British; and *Colaspis*, *Podontia*, *Phyllocharis*, *Doryphora*, *Paropsis*, *Trochalonota*, *Cyrtonus*, which are exotic.

The genus *Chrysomela*, as restricted in the latest works, is distinguished by having the palpi somewhat hatchet-shaped, the thorax transverse, the elytra separated, and the body furnished with wings. The tibiae also have a tooth or tubercle on the outside near the extremity, fringed with hairs. There are nearly thirty British species of this elegant genus, of which the *Chrysomela sanguinolenta* of Linnæus is one of the most common examples; it is about one-third of an inch long, of a blue-black colour, with the elytra widely margined with red.

The second section of this family comprises those species which have the head vertically immersed into the frontal cavity of the thorax, so that the body forms a kind of thickened cylinder, having the anterior part

cut off perpendicularly. The antennæ in the majority are almost as long as the body, and slender to the tips. Here belong the genera *Cryptocephalus*, *Eumolpus*, *Colaspis*, and *Clythra*, all of which are British, together with *Chlamys*, *Lamprosoma* and *Euryope*, exotic genera. The second genus comprises the *Eumolpus vitis*, Fabricius, a species which has become distinguished by its ravages upon the vines in the wine countries of Europe; its larva appearing in the spring, and devouring the leaves of this plant, as well as the young buds, as soon as they appear on the stems; it also gnaws the footstalk of the bunch of grapes as soon as it is exposed, causing it to droop and die; sometimes however the shoot is sufficiently strong to survive the injury, but the grapes in these bunches are of small size on that part which corresponds with the injury, in consequence of their receiving but a small portion of sap. The perfect insect is of a black colour, and pubescent, with the elytra, the base of the antennæ and tibiae, of a reddish-brown. The genus *Clythra* has the antennæ very short and serrated; the larvæ reside in tubular cases, of a leather-like texture, which they bear about with them. There are several British species.

CHRY SOPHRIS. A genus of spinous-finned fishes, belonging to the gilt-head family SPAROIDÆ, under which some notice of the genera composing that family will be found.

CHRY SOPHYLLUM (Linnæus). West Indian fruit trees of large size, yielding useful fruit called the star apple. Linnæan class and order *Pentandria Monogynia*; natural order *Sapoteæ*. Generic character: calyx five parted; corolla bell-shaped and rotate; limb divided into five spreading petals; stamens inserted in the tube of the corolla; stigma almost sitting, peltate, and of ten lobes; fruit, a round apple of from five to ten cells, each containing one seed covered with a bony shell. The foliage of these trees is beautiful, for which they have a place in our hot-houses; but they never arrive at that amplitude to produce their fruit. They are increased by cuttings like other stove plants.

CHRY SOSPLENIUM (Linnæus). A genus of three species of plants, two of them British, and frequently found on wet boggy ground, and known by the trivial name of golden saxifrage. They belong to the tenth class of Linnæus, and to the natural order *Saxifrageæ*.

CHRY SOTOSUS. A genus of spinous fishes, belonging to the mackarel family, of which the characters are: a total absence of teeth, a single dorsal fin furnished with spines, the body compressed, the scales remarkably small, and the eyes placed laterally, with the exception of the coryphenes to which they are nearly allied, this genus is one of the most beautiful that inhabits the ocean. There is one species which is occasionally met with in our seas, though it is a ranging fish, and therefore is but rarely caught. When a specimen is met with, its beauty draws a considerable degree of attention, and therefore it has had many names bestowed upon it. It is the ophah of Pennant, the *Zeus imperialis* of Shaw, and the moon-fish of other writers. It is a fish of considerable size, and so much compressed, that when seen laterally its figure is nearly round. Its caudal fin is white, and very much forked; its dorsal fin is very elevated and sithe-shaped; its ventral fins are very long; and all the fins excepting the caudal are bright red. The ground colour of the body is a beautiful violet,

marked with white spots; but the colours vary a good deal with the light in which the fish is seen. The back, as turned away from the light, appears a beautiful blue with silvery spots, while the rest of the body reflects an endless variety of brilliant colours. Its habits, further than that it is a very discursive fish, are very little known, and we believe not more than a single specimen has been met with at one time.

CHTHAMALUS (Ranzani). The shells of this genus are extremely flat; the coronary part with its sides much thicker at their base and formed of six pieces, as in the *Balani*, areas nearly equal; the internal division short, a membranous stem or support; the opening tetragonal, with nearly equal sides, surrounded by a membrane to which is attached horizontally, an operculum, composed of four pieces, slightly pyramidal. Only two species are known of this shell; they inhabit the Mediterranean sea, and are classed in the family *Balanidea*. They appear an intermediate genus between the *Balanides* with pyramidal opercula, and those with horizontal opercula.

CIBICIDES (De Blainville). A species of shell of which only one species has yet been described. The *C. refulgens*, nevertheless, is so strongly characterised, that it merits the rank of being considered a genus. Shell trochoïde, very much flattened, and umbilicated with the chambers visible and radiating from the centre on one side, conical but not spiral on the other; the aperture linear, through the height of that side. 1st class *Cephalophora*; 3rd order *Polythalamacea*; 6th family *Turbinacea*.

CICADA (Linnæus; *Cicadaria*, Latreille). A group of insects, which, in the Linnæan system, formed the genus *Cicada*, but which, from the great increase in the number of the species, and the great variations in structure which they exhibit, has been formed, by modern entomologists, into several distinct families, each consisting of numerous genera. They are characterised as a division of the order *Hemiptera*, and sub-order *Homopterita* (Kirby), by the minute size of the antennæ, which are of a conical form and terminated generally by a fine bristle, and these organs have never more than six or seven joints; the tarsi have only three joints; the wings are concealed by a pair of hemelytra or wing covers which, however, during flight, perform the offices of wings, being of a similar consistence throughout their whole extent, in which respect they differ from the *Cimicidæ* or bug tribes, in which the wing-covers are composed of two distinct kinds of membrane, or rather of corium and membrane; the proboscis, which is employed in wounding and sucking the juices of plants, arises from the under side of the head, near the fore legs; the hind legs are adapted for leaping; and the females are furnished with an apparatus well fitted for depositing their eggs, being composed of two saw-like organs, somewhat similar to those of the true saw-flies, *Tenthredinidæ*.

These insects, which from their saltatorial powers have acquired the name of tree-hoppers, are amongst the most celebrated of the lower animals. They were known to the Greeks, who were accustomed to keep them in cages for the sake of their song, under the name of *Tetrix*, and they form a favourite theme in the verses of every Grecian bard from Homer to Anacreon. "Sweet prophet of the summer," says the latter, addressing one of these insects, "the muses love thee, Phœbus loves thee, and has given

thee a shrill song, old age does not wear thee out, thou art wise, earth-born, musical, impassive, without blood, thou art almost like a god!" The hieroglyphics of Egypt, in like manner, give evidence of the attention with which these insects had been observed; and in which, from their organs of sound, which were supposed to be placed upon the back and not at the mouth, they were emblematically represented as the ministers of religion. Aristotle, who named these insects *Tetrix*, says that that they have no mouth, but a kind of tongue placed beneath the breast, and serving to suck up the dew. He likewise distinguishes two kinds of tetrix, the larger which sing, which he calls "achetes," and the smaller, which are silent "tettigonion or tettigonia;" *cicadrastæ* in Latin. The eyes were supposed to be very weak, for Pliny adds, that if the finger be placed close to them, they will creep upon it as though it were a leaf; this however is certainly incorrect, for it is well known that when they are approached, they use both their wings in flying and legs in leaping, in order to get out of harm's way. The female, says Pliny, is provided with a pointed instrument or auger, which pierces the earth, reeds, stems of the vine, &c., when the insect wishes to deposit her eggs. The pupæ of these insects have very little the appearance of the perfect flies; the body is thick and heavy, and the fore legs very large, with the anterior thighs greatly incrassated and toothed. They were called by the Greeks *Tettigometræ*, or the mother of the cicadæ. Diodorus informs us that these insects do not exist in the district of Locres, because Hercules, annoyed by their chirping, prayed the gods to deliver the country from their noise, whereupon his prayers were heard. Several Eastern nations eat these insects; the males before coupling, and the females after impregnation, are most relished. Isidore of Seville, doubtless misled by the frothy matter in which the larva of the *Cicada* (*aphrophora*) *spumaria* is found, says that the *Cigales* or cicadæ spring from the saliva of the cuckoo. "Cuculorum nascuntur sputo," Orig. lib. xxii. cap. 8. The organs by which the chirping of the cicadæ is produced, have been well described by Reaumur. They are placed on the under side of the body, between the base of the hind legs and the abdomen, and consist externally of a pair of large flattened plates of a horny texture, varying in form in the different species. When raised, they are found to conceal a large cavity partially covered with membrane of a much more delicate nature than the external covering, with a horny plate in the middle, placed horizontally along the bottom; the sound is, however, produced by a bundle of muscles still more internally, and when these strings are pulled and suddenly let go, even in a dead specimen, the sound is produced as well as though the insect were still alive, the sound issuing through an opening contrived on purpose, somewhat analogous to the sound hole of a violin. It is to be observed however, that it is only the male insects which are provided with this apparatus, the opposite sex being destitute thereof, and consequently silent; hence the couplet of the Rhodian bard, Xenarchus, not over-famed for his gallantry to the fair sex,

Happy the cicada lives
Since they all have voiceless wives.

Great diversity of opinion has been entertained of the music of the tetrix or cicada; this however may

perhaps be accounted for, from the circumstance of several distinct species having been comprehended under the same name, varying in their powers of song: thus a cicada sitting upon a harp was the usual emblem of music, which appears to have had its rise from the following legend. Two rival musicians contending upon the harp, a cicada settled upon the instrument of one of the artists, and supplied the place of a broken string, and so secured him the victory; and in Surinam these insects are also called harpers or lyre-men. By others, however, they have been held in less estimation; thus Virgil tells us that they burst the very shrubs with their noise. Some of our translators have indeed adopted the very common error, that they were insects of a very different family. Thus Dryden (Georgic iii. p. 510) sings—

When creaking grasshoppers on shrubs complain.

although from Virgil's words

Et cantu querelæ rumpent arbusta *Cicada*,
Georgic iii. p. 328,

it is evident that the insects now under consideration were alluded to. In like manner Dr. Shaw tells us, that the "cicada is perpetually dunning our ears with its most excessively shrill and ungrateful noise."

The curious apparatus with which the females are provided, for enabling them to make slits in the branches of trees for the purpose of depositing their eggs therein, has somewhat the appearance of two long narrow files, pointed at the end, moving with a separate or alternate motion, and supported by a broader back entire piece. This apparatus in the larger species is about half an inch long, and is ordinarily concealed within the terminal rings of the abdomen on its lower surface. The situations upon the twigs on which the eggs are placed, are easily recognised by the little inequalities upon the surface, placed one after the other. Each hole contains from five to eight eggs.

The preceding observations have reference to that portion of the Linnæan genus which were termed *Mannifera*, and comprises the modern family *Cicadidæ*. The divisions established at the expense of the former group (together with that of the Linnæan *Fulgoræ*, which are so intimately allied to the former, that some of the Linnæan cicadæ are now placed in the family of which *Fulgora* is the type) are as follows: 1st, the *Cicadidæ*, having the antennæ six or seven-jointed, and the ocelli three in number. This family corresponds with the genus *Tettigonia* of Fabricius, and comprises only a single genus, for which the Linnæan name cicada has been retained. Latreille, in several of his recent works, proposed several other generic divisions, but they have not been adopted. We possess in England only one species belonging to this family, which has been supposed to be the *C. hæmatodes*, but which Mr. Curtis has figured under the name of *C. Anglica*. It is met with in the New Forest. 2nd, the *Fulgoridæ*, having the antennæ three-jointed, and inserted close beneath the eyes, with a long terminal bristle; two ocelli; legs formed for leaping; no musical drums; the head is often produced in front into a nose. See *FULGORIDÆ*. 3rd, the *Cercopidæ*, having the antennæ of similar form as in the second family, but inserted between the eyes and the head, which is not rostrated. See *CERCOPIDÆ*.

CICHORACEÆ. See COMPOSITÆ.

CICHORIUM (Linnæus), is the succory of

English authors; a common plant, found by the sides of fields and highways, and is sometimes cultivated for sheep food. It has large bright blue flowers,—belongs to the class *Syngenesia* of Linnæus, and to the natural order *Compositæ*. There are several annual species, one of which, a native of India, is the well known salad plant called *Endive* (for the cultivation of which see *ENDIVE*), long cultivated in gardens everywhere. In some places on the continent of Europe, the roots of the succory *C. intybus*, are, when full grown, taken up, cut in small pieces, dried in an oven, and afterwards ground and used instead of coffee.

CICINDELIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera* and tribe *Adephaga* (*Geodephaga*, see *CARABIDÆ*) being placed by modern authors at the head of the *Coleoptera*, from the circumstance of the external lobe of the maxillæ being converted into an additional pair of feelers, forming the internal maxillary palpi. The jaws are very powerful and horny, with several strong teeth; the maxillæ are terminated by a moveable spur; the lower lip is hidden by the chin, and the eyes are very large and prominent; the legs long and slender, and the wings generally developed.

This family comprises nearly twenty genera, one only of which is found in England, namely, *Cicindela*, the remainder being in fact extra European, and consequently very little being known respecting their habits. Of these insects, which, from their ferocious habits, as well as from the spots and markings with which they are ornamented, have obtained the name of tiger beetles, there are only six or seven British species, although the genus comprises more than one hundred and twenty. Of these British species the most common is the *C. campestris*, an elegant insect, having the body of a fine green colour, with several white spots on the wing covers. Nothing can exceed the metallic brilliancy exhibited by these insects, when on the wing in the hot sunshine. They appear early in the spring (we have seen them flying this morning, April 8th, in the Horticultural Gardens); on approaching them they immediately take wing, exposing the upper surface of the abdomen, which is highly polished, and ornamented with the most beautiful colours. Their flight is however but of short duration; they, however, rise again immediately as you again approach them. The great rapidity of their motions, renders escape impossible to any luckless insect which they may attack. We have noticed that this insect emits a fine rose-like scent. Some of the species seem to make but little use of their wings, as in the British species, *C. Germanica*. The female of the *C. campestris* is distinguished by a small black spot on each elytron, not far from the base, and near to the sutural line.

The most complete account hitherto published relative to the transformations of these insects, is contained in the *Annales des Sciences Naturelles*. The larvæ reside in cylindric burrows of great depth, which they excavate in sandy situations, at the mouth of which they generally station themselves, the head of the larva occupying the mouth of the burrow. They are about an inch long, rather depressed and narrow, composed of twelve rings exclusive of the head, and the anal segment. The head is furnished, like the perfect insect, with a pair of very powerful hooked jaws; the legs are six in number, and comparatively strong. The reader will smile with us at

the following account given of one of these larvæ, described by Dr. Kidd "with an eye to science." "Oh such a beauty! the Parcæ, sweet creatures, the Eumcnides, gentle turtle doves, were lovely in comparison. Aspect vicious; temper ferocious; eyes infernal; jaws diabolical, stuck on the wrong way like a figure-head shipped looking aft; head big; back humped; the hump adorned with two hooks."—Rusticus, in Ent. Mag. The description given of the jaws is correct, and affords a curious instance of adaptation of means to an end, of which insects exhibit such numberless examples. One cannot at first but wonder what can be the cause of these jaws being so singularly stuck on the head, being in fact turned upwards, instead of downwards as is the ordinary custom in insects; but when we consider the habits of the insect in conjunction with the peculiarities of its structure, our wonder ceases; the insect takes its station at the mouth of a cylindrical burrow, in the hope of seizing upon the stray beetles and flies; now if the jaws were in the ordinary position, the insect would be compelled to throw back its head to a distance beyond its powers, were it to attempt to snap at its prey when creeping over or near the mouth of the burrow; but as the jaws are placed, it is enabled to effect this without the least difficulty. The two hooks upon the back of the eighth segment of the body are also especially worthy of notice, as it is by their assistance that the insect climbs up and retains its situation at the mouth of its cell. The amusing author above quoted turned up one of these larvæ, in order to watch its proceedings. "When first unearthed he was monstrous sulky, and lay twisted in a kind of half kink, for all the world like a pot-hook; but he soon found the inconvenience of this, and set to work to make another hole, for which he used his feet and jaws, loosening the sand with his feet, and fetching it out with his jaws," (he might have added that the back of the head being rather concave, is employed as a basket for carrying up the loosened particles); "in this way he got down about half an inch, and then adroitly hanging himself to the edge of the hole by the hook (hooks) in his back, he continued his labours in this droll position; at last he got quite out of sight, and as he did not come up again, I concluded he was taking a nap after his labour, and so I would not again disturb him." The perfect insects are very common in most sandy districts. They abound in the neighbourhood of London, and the circular orifices of their burrows may be seen in all directions, on the sunny sides of gravel pits, &c.

CICONIA—STORK. A genus of birds belonging to the *Cultrirostral* division of Cuvier's order of *Echassiers*, which answers nearly to the *Grallæ* of other naturalists; for the relations see the article **BIRD**.

The storks are a very interesting race, whether we regard their size or their habits; and in those countries where the rains are periodical, much of the country laid under water for a time, and numerous animals remain left by the subsiding waters, which would taint the air if they remained and were decomposed there, they perform a very important office in the general economy of nature. They are all more or less migratory, and, with the exception of the colder latitudes, are found on the low grounds in almost every part of the world, though the true storks are mostly confined to the eastern continent.

The characters are: bill long, straight, stout, even, cylindrical, in the form of a lengthened cone, acute, cutting ridge, rounded, of equal height with the head; the under mandible slightly bent up; nostrils longitudinally cleft in the horny substance, and placed in a groove; eyes surrounded with a naked space which does not communicate with the beak; legs long, and furnished with four toes, of which the three anterior are connected at the base by a membrane, and the hind has its first joint resting on the ground; wings of moderate size.

Storks live in marshy situations, and feed principally on reptiles, frogs and their spawn, as well as on fish, small mammiferous animals, and birds. In many countries they are a privileged race, being cherished and protected, on account of the noxious animals which they destroy. They moult in autumn, migrate in large bodies, and are easily tamed. The young of the first year do not very materially differ in appearance from the full grown birds; but they may still be recognised, on their return in spring, by the dull black and white of their plumage. The sexes are not dissimilar in appearance.

Storks have no voice, properly so called, though when they are irritated, or otherwise strongly excited, they contrive to make a clanking noise, by beating the edges of their mandibles, which are very hard and strong, against each other; when they do this they place the head in rather a singular position; they recurve it backwards, until it is nearly parallel with the back, and leaning on it. In this position the upper mandible is undermost, and held firm by the posture of the neck, while the under, which is now uppermost, beats much more easily and forcibly against the other than if the bill were in its natural position, as in this case the weight of the mandible aids the stroke, while it acts against it in the other. It does not appear that the muscles which move the under mandible, strong as they are, would be capable of performing this singular sort of cymbal playing, if the weight of the organ were not brought to their assistance; for as the bird brings its head back to the natural position, the sound gets lower, and when it snaps with the bill in the natural way, no sound is produced.

Storks are birds of long flight and powerful wing, and they rise high and proceed gracefully upon their long aerial journeys; on the ground their march is rather slow but stately, their steps being long and measured. As is the case with most birds of the order, they carry the foot forward simultaneously with the leg, and this sort of locomotion is owing to a peculiar system of articulation. To the same mechanism the storks are indebted for the faculty of sleeping upon one leg, holding the other bent, and often even suspended rectangularly. The pleasant story told by Boccaccio, of the gentleman and his cook, affords an agreeable illustration of this habit of the stork: a roasted stork had been ordered for dinner, and the legs of this bird being the most substantial as well as the most juicy parts of it, the master was of course anxious to have them for his own use. But there was another claimant: the cook had a sweetheart, and she was so urgent for a leg of this stork that the gallant cook was constrained to cut it off and give it her; when the mutilated stork made its appearance on the table, the master, in a great rage, sent for the cook, and charged him with having purloined the leg. "Storks have but one leg, sir," said the cook with the ut-

most composure; "and if you will condescend to repair with me to the bank of the river to-morrow morning, I will convince you of the fact." Morning came, the river was visited, and sure enough there was a number of storks, all of which appeared to have but one leg. "There they are, sir," said the cook, "and you see there are no more legs than storks." "Hoo!" said the master, upon which every stork displayed his other leg. "Now," said the master, "have not I convinced you what a cheat you are?" "I beg your pardon, sir," said the cook, "not one of these storks put down his other leg till you cried 'hoo,' and of course if you had cried 'hoo' to the stork yesterday, he would have put down his other leg too." We shall now give some account of some of the principal species.

WHITE STORK (*Ciconia alba*). White, with the orbits naked and crimson; quills and upper tail-coverts dusky green. The irides are brown; and the feathers on the breast long and pendulous. Length about three feet and a half; extent of wing upwards of six feet; size about that of a turkey. The young have the black of the wings tinged with brown, and the bill of a dusky red. A pure white variety, called *Sterehi* by the Bulgarians, is found in the valley of the lower Danube.

From the familiarity of their disposition, and its other moral habits, the stork is one of the most popular of littoral birds, and has been generally regarded as the friend of man, attached to his dwellings, nestling on roofs and chimneys, eating on the banks of the most frequented rivers, in cultivated fields, and almost in gardens, not even shrinking from the bustle of crowded cities, taking up its abode in towers, and everywhere respected and welcomed. In Holland it is protected, because it checks the multiplication of reptiles in the marshes and humid flats; the Vaudois cherish and venerate it for its friendly offices; the Arabs, in like manner, treat it with the most hospitable regard; and the Turks and eastern tribes consider it as a sacred bird, which they are forbidden to kill. At Constantinople, accordingly, the storks build their nests in the streets; but in other countries they generally prefer a lofty situation. A Mussulman cannot patiently bear to see one of them molested; and the ancient Thessalians made the killing of them a capital crime. The Moors, too, religiously abstain from offering violence to them; and hence the valley of Monkazem appears to be the resort of all the storks of Barbary, which, in this district, are more numerous than the inhabitants.

The white stork is of gentle manners, easily tamed, and manifests a sense of cleanliness. Although it has a pensive and even melancholy air, it occasionally indulges in gaiety and pastime, associating even with children, and partaking of their amusements. "I saw in a garden," says Dr. Hermann, "in which the children were playing at hide and seek, a tame stork join the party, run its turn when touched, and distinguish the child who was to pursue the rest so well as, along with the others, to be on its guard." Among the engaging attributes of these birds have been justly reckoned gratitude, conjugal fidelity, and filial and parental affection. They seem in fact to be very sensible of kind treatment saluting, with a noisy flapping of their wings, the houses whose inmates had given them a friendly reception during the preceding season, and repeating the same ceremony on taking leave. With wonderful constancy the same pair

return to the same haunts, and join in mutual and fond caresses after their long voyage. The tender affection which the stork manifests towards her young, has been proverbial even from remote antiquity. She feeds them for a considerable period, nor quits them till they are strong enough to defend themselves, and to provide for their own subsistence. When they begin to flutter about the nest, she bears them on her wings, and protects them from danger; and she has been known rather to perish along with them than abandon them to their fate, an affecting instance of which was exhibited in the town of Delft, in 1636, when a fire broke out in a house that had a stork's nest on it, containing young that were then unable to fly. The old stork, returning with some meat for them, and seeing the danger in which they were exposed, the fire having almost reached the nest, made several attempts to save them, but, finding all in vain, she at last spread her wings over them, and in that endearing attitude expired with them in the flames. Young storks have also often been observed to lavish the most affectionate and assiduous cares on their aged and infirm parents; and the ancient Greeks, observant of this striking instinct, enacted a law to compel children to support the authors of their existence, and the guardians of their infant years.

The stork is capable of sustaining a lofty flight, and of performing long journeys even in tempestuous weather. When on wing it pushes its head straight forward, with the feet extended backward. It returns to Alsace about the end of February, to Switzerland in the course of March, and to Germany early in May, but it rarely visits this country. If a pair on their return find their former nest deranged or demolished, they repair it with sticks, rushes, and other plants that grow in moist situations. It is usually placed on high roofs, the battlements of towers, and sometimes on the tops of tall trees, on the brinks of streams, or on the projection of a precipitous rock. In France it was formerly customary to lay wheels on the roofs of houses to induce them to build on them, a practice which still exists in some places. In Holland boxes are placed on the roofs of houses for the same purpose. The hatch consists of two, three, or four eggs of a yellowish sordid white, larger than those of the goose, but not so thick. The male sits on them while the female is abroad for food. The young make their appearance in the course of a month, when the parents diligently search for and carry to them the proper aliment, which they disgorge from their gullet or stomach. Both parents never leave the young at the same time, but while the one is ranging in quest of food, the other keeps watch, standing on one leg in the manner above described, and with its eye steadily fixed on its charge. When the young first break the shell, they are covered with brownish down; and their legs are so weak that they are not able to move in the nest in any other way than by shuffling about upon their knees. When their wings begin to acquire strength, their mothers accompany them in easy flights, though it is rather too much to assert, as is sometimes done, that they literally *teach* them to fly. There is no teaching, in the ordinary sense of the word, among animals of any kind, either in motion or in voice. The supposed teaching in walking or flight is merely the old ones keeping company instinctively with the young; and the teaching of music is simply rivalry in that impulse which occasions the song.

In some places storks nestle very thickly together, but they always live in the greatest harmony. At Bagdad there are hundreds of nests, on the houses, the walls, and the trees; and among the ruins of Persepolis, there is a stork's nest on the top of every nodding fragment and mouldering column.

About the month of August they begin to move from their more northerly haunts; and they move sooner in moist and cold seasons than in dry and warm ones. Previous to their departure they assemble in very numerous flocks upon some plain, and hold a conversation in that peculiar clanking of their bills of which we have taken notice. The motion of the mandible while this is performing is very rapid, and the clattering which they make is considerable. Sometimes they meet, break up, and meet again, before they take their final departure. When they do move off, it is done in perfect silence, and often during the night; and they also arrive in silence, so that neither the beginning nor the end of their journeys is often noticed. They rise rapidly to a great height, and as they utter no sound when on the wing, they are seldom observed when passing over the plains. But on the mountains they are more easily seen; and the flocks of them which are observed from such points of view are often very numerous. Shaw, the traveller, mentions having seen flights of them passing over Mount Carmel in their flight northward from Egypt, a mile in breadth, and taking three hours before they all passed over the point of observation. In Asia and the east of Europe they are very numerous, ranging into Siberia, into Russia, and even into Sweden; and they do not seem to be much affected by the cold. Those which breed in the north, in the early part of the season, generally have another brood in Egypt and the other southern countries; but they do not all quit these southern latitudes; and some of them are stationary in the east of Asia, and in some of the Asiatic islands, as well as in the north of Africa. In all their characters and habits they are very interesting birds; they may be said to be almost tame in a state of nature; and they live in confinement without any apparent inconvenience, or even much reluctance; but confinement is obviously contrary to their habits, as they do not breed in that state, and whenever animals cease to obey this, the strongest impulse of nature, we may safely conclude that the state is not one for which nature designed them. It is also worthy of remark, that, generally speaking, these animals, which will not breed in confinement, and therefore cannot properly be domesticated, are never of so much use to man as those which breed freely. Notwithstanding the tale of Boccaccio, the stork is very far from being a *bonny hawke*, even to the most perverted epicure; for its flesh is not very nutritious, and it is at the same time far from being savoury; therefore, there is but little temptation for taking the bird out of that state of nature in which it has so many interesting points.

THE BLACK STORK (*Ciconia nigra*). The black stork measures about three feet in length. The upper part is blackish, with metallic reflections; and the lower part of the breast and the belly white. The naked space round the eyes, and that on the neck, and also the bill, are crimson: and the feet are deep red. The colours of the young are different, the upper part being blackish-brown, with reflections; the feathers on the head and neck brown, with red-

dish borders; and the naked skin round the eyes and on the neck, and also the feet, are olive green. In consequence of this difference of colour, the young birds have sometimes been described as a different species, under the name of the brown stork.

Though these two birds agree in their general characters, the habits of the black one are, in many respects, the reverse of the white. Like that it is a ranging and migrant kind; but, instead of resorting to towns and inhabited places, it seeks those which are lonely and sequestered. Its haunts are the remote and inaccessible marshes, and the borders of lakes which are seldom visited. It is found in considerable numbers in the more sequestered parts of the Alps, always on the borders of the waters, where it subsists, at least in part, by fishing. It hovers over the surface, and occasionally plunges down to snatch its prey. It occurs in Poland and Prussia, and partially in Germany, also in some parts of France; but it is very rare in Holland where the white species is very plentiful. Indeed it seems to shun not only the peculiar haunts, but the countries which are most frequented by its congener. In Britain it has occurred only as a very rare straggler.

It builds in trees, in the depth of the forests; and, as is the case with several others of the larger birds of this division of the order, it appears to prefer fruit to any other trees, no doubt because it can stand on the horizontal branches which these send out, much better than on the sprays of deciduous trees. The eggs are from two to four, of a dull greenish white, with some blotches of brown, which do not appear to be constant. Though these birds sometimes fish, fishing is not their peculiar, or even their principal, resource. They feed upon reptiles, mollusca, insects, the smaller ground mammalia, and also upon any animal remains or offal which they can procure. They are voracious birds and appear to migrate after their food rather than in consequence of any other instinct. On their long journeys they are birds of very lofty flight ascending upwards till, notwithstanding their large size, they are barely, if at all, visible. They may be partially tamed; but there is little inducement to tame them, as they have not the interesting manners of the white storks, and their flesh is even less palatable.

THE AMERICAN STORK (*Ciconia magnari*) is described as differing from the white stork of the eastern continent chiefly in having the bill of an ash colour. It is white, with the wings and upper tail-coverts black; the irides white, and the feet red. It is about three feet in length. Its principal locality is said to be to the eastward of La Plata in the uninhabited part of the pampas. Some of the accounts state that it breeds in confinement, but this is contrary to the general habit of the genus.

A few more species and varieties have been mentioned, such as the small black stork of Northern Africa, and the purple stork of India; but the accounts of them are a little confused. Some notice of the great stork of India, which is an allied species, will be found under the article **ADJUTANT**; and the Jaribus will be noticed in the article **MYCTERIA**.

CIMBEX (Olivier: *Crabo*, Geoff.). A genus of hymenopterous insects belonging to the section *Securifera*, and family *Tenthredinidæ*, and forming together with the several sub-genera which have been separated from it by Dr. Leach, (*Zaræa*, *trichiosoma*, *Abia*, *clavellaria*), a section in that family distinguished

by having the antennæ short and knobbed at the tip, and composed of only four, five, or six joints; the wings are large, with the costal and sub-costal nerves of the upper pair soldered together; the spurs of the tibiæ are blunt, and the joints of the tarsi are provided beneath with spongy cushions. These insects are amongst the largest species of the saw-flies, whose curious economy in the formation of the cells for the reception of their eggs and the apparatus with which they are furnished for forming these cells will be subsequently related. They are produced from large fleshy larvæ which greatly resemble the caterpillars of lepidoptera, whence they have been termed by the French entomologists "fausses chenilles," but they are provided with a greater number of legs, the true caterpillars not having more than sixteen, whilst the larvæ of cimex have twenty-two, the eleventh segment of the body being alone destitute of these organs. It is a curious circumstance that larvæ so closely resembling each other, as those of cimex and some of the moths belonging to the family *Noctuidæ*, should produce insects so totally different. In their former state they both feed upon the leaves of the same tree, and their whole appearance is so similar that it would be impossible for a person unused to entomological pursuits to conceive which of the two would produce the moth, whilst in their perfect state no two insects would be found more unlike, in characters, habits, appearance and structure. The transformation of two of the largest species, *Cimex lutea* and *sylværum*, have been observed by Lyonnet, whose excellent figures, published in his posthumous researches, represent the entire structure of the insects in great detail. The larvæ of the former, having obtained their full growth, descend into the earth in the month of July, where they form cocoons of a very firm consistence, in which they undergo their change to the pupa state, the flies making their appearance shortly afterwards.

CIMEX (Linnæus). A group of insects of very considerable extent, forming in the Linnæan system a single genus under this name, belonging to the order *Hemiptera*. In the modern system of entomology, this group has been divided into numerous distinct families, each comprising various genera and sub-genera, and the whole has been raised, under the name of *Geocoris*, or land bugs, to the rank of one of the three divisions of the heteropterous portion of the order *Hemiptera*, the two other divisions having for their types the genera *Nepa* and *Notonecta* of Linnæus. As a group, therefore, the *Geocoris*, or Linnæan cimex, is distinguished by the antennæ being exposed, longer than the head, composed of four or five joints and inserted between the eyes, near to their inner margins. The tarsi are three-jointed, the basal joint being often very small, the body is of an oval or oblong form, the legs are formed for running, the wings are membranaceous, not longitudinally folded, and covered, when at rest, by a pair of wing-covers, of which the basal portion is of a leather-like consistence and opaque, whilst the extremity is membranaceous and more transparent, the thorax or rather the prothoracic segment is of a large size and performs the office of a thoracic shield as in the coleoptera, whereas in the homopterous division of the order it is small; the wings and wing-covers when at rest are horizontal or at least but slightly inclined—sometimes, as in the bed-bug, they are entirely wanting. The mouth consists of an elongated and articulated proboscis, includ-

ing several fine setæ which are employed in wounding vegetable or other substances upon which these insects feed. Latreille has divided this group into various families, or rather sub-families, to which the following names have been applied:

1st. The *Pentatomidæ*, having the antennæ five-jointed, the rostrum four-jointed, the labrum or upper lip long and transversely striated.

2nd. The *Coreidæ*, having the antennæ four-jointed, the rostrum four-jointed, the second joint longer than the third, the ocelli at the same distance from each other as from the eyes.

3rd. The *Lygæidæ*, differing from the latter in having the second joint of the rostrum shorter than the third, with the ocelli placed near the eyes. The species are of small size and obscure colours, and are generally found in the ground.

4th. The *Capridæ*, being destitute of ocelli, and having the terminal joint of the antennæ very slender and the rostrum four-jointed.

5th. The *Cimicidæ* (*Membranaceæ*, Latreille), having the rostrum very short, and only two or three jointed, the labrum short and not striated.

6th. The *Reduviidæ*, having the rostrum very short, but exposed, curved, and of considerable strength, and the head is narrowed behind into a neck.

7th. The *Acanthiidæ*, having the rostrum three-jointed, but long and straight, the body of an oval flattened form, the head not narrowed into a neck, and the eyes very large and prominent. These insects are of small size, very active and frequent the borders of streams.

8th. The *Hydrometridæ*, having the body long and narrow, the four hind legs generally inserted at the sides of the body, so as to be employed in skinning on the surface of the water.

Under the word BUG we have made some general observations upon the habits and transformations of this group of insects, as well as upon the fifth of the families given above. Referring our readers thereto we shall consider the present article as one relating rather to the modern classification of the Linnæan Cimices, and shall therefore only add that M. De Laporte has lately published a valuable work upon this branch of the hemiptera, in which various other sections of inferior value are given, in the *Magazin de Zoologie* of M. Guérin.

CINCHONA (Linnæus). A genus of two species of Peruvian trees or shrubs, yielding the famous Jesuits' bark, so celebrated as a febrifuge. Linnæan class and order *Pentandria Monogynia*; and natural order *Rubiaceæ*. Generic character: calyx five toothed; corolla funnel shaped; limb of five spreading parts; stamens attached to the tube, sometimes included; anthers linear, two celled, bursting lengthways; style simple; stigma cleft, capsule two celled, many seeded, opening in the middle; seeds winged, with a notched margin. The bark is obtained from the trees in their native country, and exported in great quantities to all parts of the civilised world. These plants have long been introduced into British collections, but are still rare. Ripened cuttings strike root under careful management, in moist heat.

CINCHONACEÆ—cinchona family. A natural order of dicotyledonous plants, containing two hundred and twenty-three genera, and upwards of nineteen hundred species. This order has been by many authors denominated *Rubiaceæ*, on account of the genus *Rubia* or madder, having been included under

it; as however this genus is more properly referred to a distinct order, *Stellatæ*, the name *Rubiaceæ* is no longer applicable. The order is allied to *Compositæ*, but differs in the mode of its inflorescence, in its stamens not being united, and in its ovary having two or more loculaments. To *Apocynæ* it also bears a considerable relationship, but is easily distinguished by the æstivation of its corolla, its inferior ovary and the presence of stipules. *Caprifoliaceæ* is also quoted by authors as an allied order.

The order *Cinchonaceæ* is thus characterised: calyx adherent to the ovary, simple, either undivided or with a definite number of divisions; corolla of one piece, superior, tubular, with a definite number of divisions equal to those of the calyx, and with a twisted or valvate æstivation; stamens arising from the corolla, equal in number to the lobes of the corolla, and alternate with them; anthers oval, two celled; pollen elliptical; ovary inferior, usually two celled, crowned by a disk; style single, sometimes partly divided; stigma simple, sometimes divided into a definite number of parts; fruit inferior, baccate, capsular or drupaceous, two or many celled; seeds definite or indefinite, in the former case erect and ascending, in the latter attached to a central axis; albumen copious, horny or fleshy; embryo straight or slightly curved; radicle turned towards the hilum; cotyledons foliaceous.

The plants included in this order are trees, shrubs or herbs, with simple, entire, opposite or verticillate leaves, and panicled or corymbose flowers. They grow in the hotter parts of the world, and are said to constitute a twenty-ninth part of the whole flowering plants of the tropics. They are nearly allied to each other in their properties. The barks of most of them contain an astringent bitter principle, which frequently possesses febrifuge virtues, and the roots of many of them are emetic and purgative.

This order has been divided into twelve distinct sections: 1. *Cinchonææ*, or true cinchona tribe, in which the capsule is two-celled, with a septicidal dehiscence, the cells containing many winged seeds, and the stamens being five or more. This section includes the genera *Cinchona*, *Exostemma*, *Pinckneya*, *Naucleya*, *Uncaria*, &c. 2. *Gardeniææ*, in which the fruit is fleshy, indehiscent, bilocular, and the seeds are not winged. In this section are included the genera *Gardenia*, *Sarcocephalus*, *Genipa*, &c. 3. *Hedyotideææ*, in which the capsule is two-celled, with a loculicidal dehiscence, the cells being many seeded, and the seeds not winged. Examples of this section are seen in the genera *Hedyotis*, *Condaminea*, *Macrocremum*, *Portlandia*, *Oldenlandia*, &c. 4. *Iseritiææ*, in which the fruit is drupaceous, and is provided with from two to six nuts as in *Iseritia*, *Metabolos*, &c. 5. *Hameliaceææ*, of which the fruit is a many celled, many seeded berry, as is seen in the genera *Hamelia*, and *Labacca*. 6. *Cordiéreææ*, in which the fruit is a many celled berry, each cell containing a single seed, as in *Cordia*. 7. *Guettardaceææ*, in which the fruit is a drupe having from two to ten nuts inclosing smooth seeds. Examples are seen in the genera *Guettarda*, *Morinda*, *Vauquieria* and *Antirrhæa*. 8. *Pæderiææ*, having a bilocular, indehiscent fruit and a fleshy albumen, as in *Pæderia*. 9. *Coffeaceææ*, or coffee tribe, in which the fruit is a bilocular berry, and the albumen is horny. This section is illustrated by the genera *Coffea*, *Cephaelis*, *Sidcrodendron*, *Chiococca*, *Ixora*, and *Psychotria*. 10. *Spermacocceææ*, in which the fruit is

somewhat dry, inclosing two or four nuts, and the stigma is bilamellar, as in *Spermacocca*, *Borreria*, and *Richardsonia*. 11. *Anthospermeææ*, in which the fruit is somewhat dry, and the stigma elongated and hairy, as in *Anthospermum*. 12. *Operculariææ*, in which the fruit has one loculament and one seed, with a bivalvular dehiscence, as occurs in the genus *Opercularia*. To these sections many botanists add another, *Stellatææ*, including the genera *Rubia*, *Galium*, &c., which are met with in northern latitudes. This section is, in our opinion, with some propriety reckoned a distinct order, and, as such, will be noticed by us in the course of this work.

In treating of the nine important plants which are met with in this highly interesting order we shall commence with the genus *Cinchona*, whence the name of the order is derived. This is a very extensive genus, the species of which are, however, as yet imperfectly known, notwithstanding the labours of Mutis, Zea, Tafalla, Ruiz, and Pavon, Humboldt, and Bonpland, and the valuable monographs of Vahl and Lambert. It holds an important place in Medical Botany in consequence of furnishing Peruvian bark. There are three species mentioned in the British Pharmacopœias, *Cinchona lancifolia* which furnishes the pale bark of the shops, or the brown bark of commerce, *Cinchona cordifolia* which supplies the yellow bark, and *Cinchona oblongifolia* which is the source of the red bark. Besides these there are several other species of cinchona which produce medicinal barks, such as *Cinchona ovalifolia*, *Magnifolia excelsa*, *Ferruginea*, *Vellozii* and *Remigiana*.

The cinchonas inhabit chiefly those districts of South America which are situated on the west of the Andes: some are found in Brazil, and one, *Cinchona excelsa*, grows in the East Indies. They are found at a considerable elevation, generally from six to eight thousand feet above the level of the sea, and require a mean temperature between 59° and 62° of Fahrenheit. They are handsome evergreens which attain a great height, and, when allowed to grow, acquire a considerable thickness of trunk. The stripping of the bark, an operation which is now performed on a very large scale, prevents the trunks of the trees from acquiring the same diameter as formerly. Some doubts have also been entertained as to the probability of the supply of cinchona being kept up, in consequence of no pains being bestowed on the cultivation of the trees, which frequently die after being deprived of their bark.

The bark is generally taken in the dry season during the months of September and December, and it is known to be in a proper state, when, on raising a portion of it, the air gives it a reddish colour. After removal from the tree, it is dried and separated into different sorts so as to be fit for exportation. The younger the branch is the more the bark is quilled or rolled; sometimes, however, it is quilled by the application of heat.

The cinchonas have been divided into those species having hairy, and those having smooth, corollas, the former being decidedly febrifuge, the latter not. Among the former are the species, *lancifolia*, *cordifolia*, *oblongifolia*, *ovalifolia*, *Braziliensis*, *excelsa*, &c. while the latter have been lately included under a distinct genus to which the name *Exostemma* has been given.

Cinchona lancifolia, pale bark, so called from the colour of its powder, is found on the declivities of hills in Peru, between 4° and 5° of north latitude,

and attains a height of thirty or forty feet. This species, from being the first introduced into Europe by Condamine, has been called, by Humboldt and Bonpland, *Cinchona Condamine*. The bark of this species generally occurs, in commerce, in the form of small tubes or quills, which are covered with a rough epidermis on which numerous lichens grow. These lichens are of importance, as indicating the peculiar quality of the bark. The bark, bearing lichens of the genera *Graphis*, *Lecanora* and *Usnea*, is esteemed good. These lichens ought to be scraped off before the bark is powdered for use. There are several varieties of pale bark, imported from Loxa and Guanaeo, of which the chief are, the quilled bark of Loxa, or Cascarilla de Loxa, the grey bark of Loxa, the bark of Lima, and the Havannah bark.

Cinchona cordifolia, yellow bark, is a handsome tree, which grows abundantly on the mountains of Loxa and Santa Fé, in the fourth degree of north latitude, at an elevation of six or seven thousand feet above the level of the sea. The bark of this species is thicker, less quilled, and more woody and fibrous than the pale bark. It is frequently completely devoid of epidermis, and more especially when not quilled. There are two varieties of the bark in commerce, the Calisaya or royal yellow bark, and the orange yellow bark. The yellow bark is less astringent and more bitter than the pale bark.

Cinchona oblongifolia, red bark, grows in new Grenada, near Maraquita, in the fifth degree of north latitude. There are two varieties of this bark, the smooth red bark, or the quina roxa, or colnada of commerce, and the warty red bark of Santa Fé de Bogota, which is considered by some authors as the produce of *Cinchona magnifolia*.

Cinchona or Peruvian bark has been long known as a febrifuge, and seems to have been employed as such in Peru at the time of the Spanish conquest; but no accurate accounts are given of the time when it was first used. Among the many fables which have been circulated in regard to this bark, it has been stated that its efficacy in fever was accidentally discovered by a person afflicted with ague, who drank the water of a stream into which a cinchona tree had fallen, and to which it had imparted its virtues. The Jesuits in early times used to distinguish the different kinds of trees by chewing their bark, and it is said that they were attracted by the peculiar bitterness of the cinchona, and employed it in the cure of disease. On this account it long retained the name of Jesuits' bark. The name cinchona is derived from the circumstance of a cure having been effected by means of the bark, in the case of the Countess of Cinchon, lady of a Count who acted as Spanish viceroy in Lima, from 1629 to 1639.

Cinchona bark, on its first introduction into Europe, met with great opposition from medical men, who were prejudiced against it chiefly on account of its novelty. Its failure too in the cure of many diseases, for which it was at first extolled as an infallible remedy, would lead physicians to doubt its efficacy in any disease whatever. After careful observation and repeated trials, the powers of cinchona were at length fully ascertained, and its reputation as a remedy of great importance was completely established. It soon became an important article of commerce, and was admitted into the materia medica. It is now extensively used all over the world, and large quantities are annually imported into Europe from Guay-

aquil, Lima, Loxa, Buenos Ayres, Carthagena, Santa Martha, and other parts of South America.

The value of Peruvian bark has frequently led to its adulteration; a considerable degree of care and attention are required in its selection. By inattention to this, and the consequent employment of spurious barks, the true article has often been brought into disrepute. Good bark is dense, heavy and dry, not musty or spoiled by moisture, and a decoction of it is red while warm, and becomes paler on cooling. Barks, which are simply internally bitter or astringent, or merely mucilaginous, whose surface is smooth or of a dark colour, whose fracture is fibrous, and internal colour white or grey, are bad, and ought to be rejected. The means of distinguishing good bark were of greater importance formerly, when the bark was constantly used in substance, than now-a-days, since the discovery of the active principles of the bark. For this important discovery we are principally indebted to the labours of French chemists, although Dr. Duncan, formerly professor of materia medica in the University of Edinburgh, was undoubtedly the first who suggested the existence of a peculiar principle in bark. By the researches of MM. Pelletier and Caventou, it has been ascertained that there exist in cinchona two alkaloids, to which the names of cinchonia and quinia have been applied, and which possess in a concentrated degree, the properties of the bark itself. These alkaline substances exist in combination with a peculiar acid called kinic acid, and their quantity varies in the different kinds of bark. According therefore as we wish to procure the one or the other, we must select a particular sort of bark for the purpose. Pale bark yields chiefly cinchonia, and the yellow furnishes quinia, with a small proportion of cinchonia, while in the red bark both these substances exist in nearly equal proportions. It will be seen that thus the barks are not only distinguished by their colour, and the other characters formerly noticed, but also by their chemical constituents. Besides these alkaloids, bark consists of kinate of lime, fatty matter, red colouring matter, tannin, yellow colouring matter, gum, starch, and lignin, or woody fibre.

By a particular chemical process we are able to separate the active principles of the bark from all the impurities which exist in it, and in this way obtain most valuable articles of materia medica. To procure cinchonia, the pale bark is powdered and boiled in water, along with a quantity of sulphuric acid or oil of vitriol. This process is repeated several times with fresh portions of acidulated water, until all the soluble matter is extracted. The decoctions thus made are evaporated and mixed with newly-slaked lime, which forms an insoluble sulphate of lime, and carries down the cinchonia as a precipitate along with it. On adding boiling alcohol to this precipitate after it is dried, the cinchonia is dissolved, while the sulphate of lime is left; and the former is afterwards procured in a crystalline state by evaporation, and may be purified by the addition of animal charcoal, and a second solution in alcohol. When thus obtained in a pure state, cinchonia is a white, crystalline salt, having a bitter taste, nearly insoluble in cold water, and requiring 2,500 times its weight of boiling water for solution. Owing to this insolubility it does not act powerfully on the animal frame, unless in combination with some acid, such as the sulphuric. The kinic acid, with which cinchonia is combined in the

bark, has no particular medicinal properties; it merely renders the alkaloid more soluble. The sulphate of cinchonia is sometimes used in medicine, but it is much inferior in tonic power to the sulphate of quinia, which is prepared from the yellow bark. In order to procure the latter salt, the yellow bark is treated in a similar manner to the pale bark, in the preparation of cinchonia, being first boiled in acidulated water, then mixed with quicklime, in order to precipitate the quinia, which is little soluble in water, but which is easily dissolved in alcohol, and afterwards combined with sulphuric acid. There is thus formed a pure white salt, which crystallises in the form of silky needles. This sulphate is now in general use, in consequence of possessing all the tonic and febrifuge properties of bark, in a concentrated state. It is capable of being administered in large doses without producing nausea, and is much more active and powerful than the bark itself. It is now manufactured on a large scale, both in this country and in France. In the year 1826, no less than 1593 hundred weight of bark was used by four chemists in Paris, and 90,000 ounces of sulphate of quinia or quinine were produced in France the same year. It is sometimes adulterated with white sugar, starch, sulphate of lime and boracic acid.

Bark is employed medicinally as a stimulant tonic, astringent and antiseptic. It is administered either in the form of powder, infusion, decoction, tincture or extract. The sulphates of cinchonia and quinia are chiefly employed in the present day. Bark and its alkaline preparations are used extensively in the cure of intermittent fever, being given in large doses during the intervals or intermissions. When given in substance, bark is best administered in milk, which completely covers its flavour, provided the doses be swallowed the instant it is mixed with the milk. Bark is also used in other febrile diseases, in rheumatism, in dysentery and chronic diarrhœa, in gangrene or mortification, in various passive hæmorrhages, in scrofulous states of the system, in stomach complaints, in tic douloureux, and in various nervous and convulsive diseases. It is also used as tooth powder, and has a beneficial effect in strengthening the gums. Cinchona and its preparations ought not to be administered when there is any marked inflammatory tendency, or when there are any symptoms of an affection of the liver.

Acids in their concentrated state, white vitriol, lime water, corrosive sublimate, tartar emetic, rhubarb, and several other substances, form precipitates with cinchona, and cannot be administered in conjunction with it.

We shall next notice the genus *Coffea*, which contains thirty-five known species, some of which are cultivated in Europe. *Coffea Arabica* is the most interesting of the species, on account of furnishing the well-known article of diet called *Coffee*. It is an ever-green tree, originally a native of Arabia and Ethiopia, whence it has been transplanted into different quarters of the globe. It seems to thrive best in hilly dry soils, with a mean temperature of 70° or 75°. The tree grows to the height of fifteen or twenty feet, and has an erect trunk, two or three inches in diameter. It bears pure white, sweet-scented flowers, and roundish berries, the size of a cherry, of a dark red colour when fully ripe, and containing two seeds. These seeds are somewhat oval, convex on one side, flat and furrowed longitudinally on the other. They are

covered with a membranous endocarp, to which the name of *parchment* has been given, and which has been by many botanists improperly styled an arillus. The common beverage of coffee is made by the decoction or infusion of the roasted seeds, the part roasted being the hard or horny albumen.

Coffee has been introduced in comparatively recent times, and was totally unknown to the earlier nations, such as the Greeks and Romans. It is stated that in Caffa, a district of Ethiopia, where the coffee tree grows abundantly, the seeds were at a very early period employed as an article of food. According to Raynal, the coffee-tree was introduced from Ethiopia into Arabia, towards the end of the fifteenth century. Whether this statement be correct or not, it is well known that the tree has been long cultivated in the neighbourhood of the Arabian town of Mocha. From Arabia, coffee was early brought to Europe, and its property of producing wakefulness, and preventing sleep, seems, in the first instance, to have been the circumstance which led to its use.

Coffee-houses were established in Persia about the middle of the fifteenth century. From thence coffee was carried to Cairo, and ultimately to Constantinople, where it was publicly sold in the year 1554. In both these last mentioned cities, the use of coffee was for some time prohibited, on account of peculiar religious scruples. These however were soon overcome, and the beverage came to be universally used, particular persons being appointed by government to superintend the preparation of it. In the beginning of the seventeenth century coffee found its way to Venice, and in 1644 we find that it had reached Marseilles. The celebrated traveller Thevenot brought it to Paris in 1657, and in 1672 a coffee-house was opened in that metropolis by an Armenian named Pascal, who subsequently established one in London.

About the middle of the seventeenth century, Daniel Edwards, a Turkish merchant, brought to this country a Greek servant, named Pasqua, who understood the mode of roasting and making coffee, and who afterwards kept a coffee-house in George Yard, Lombard Street. Coffee now becoming an important article of commerce, was included in the statute-book, and a duty of fourpence was laid on every gallon of coffee made and sold. In the time of Charles II., in consequence of various political meetings taking place in coffee-houses, an order was issued that they should be shut up; this, however, was very soon rescinded. Ray says that in 1688 London rivalled Grand Cairo in the number of its coffee-houses.

From the extensive use made of coffee it became an object of importance to cultivate the tree, and accordingly we find that the Dutch, so early as 1690, transplanted the coffee tree from Arabia Felix to their settlements in Batavia. Their example was afterwards followed by the French, who introduced the plant into their possessions in the Antilles. Coffee becoming an object of interest to most nations, the tree was soon cultivated in most parts of the East and West Indies. Its produce is now known all over the world, and may be said to have become one of the necessaries of life. It may be here stated that, though the coffee tree thrives well in the West Indies and the other parts of the world into which it has been transplanted, still the fruit it produces in these countries is not equal in flavour to that furnished by it in Arabia, and Mocha coffee still maintains its eminence in the market.

In the coffee plantations the trees are raised from seeds, and are afterwards transplanted into nursery lines. The plantations are situated on the sides of hills or mountains, and the trees are generally ten feet apart. The produce of a good tree is said to be one or two pounds of berries. These berries when fully ripe are gathered and put into a particular kind of mill, in order to be deprived of their outer pulp. The seeds are then soaked in water, and are subsequently well dried before being deprived of their parchment or membranous covering by means of a machine called the peeling-mill. They are afterwards subjected to the action of a winnowing-mill, which removes any loose pellicles which may be mixed with them. In this state they constitute the raw coffee beans of commerce, which require to be roasted and ground to powder before being fit for use. In this country the roasting is performed in cylinders, which are made to revolve over a charcoal fire, while in France this operation is performed generally in open pans. In Turkey a sort of coffee, called Sultan's coffee, is prepared from the fleshy mass which covers the seeds. It is said to be less heating than common coffee, and to possess gently laxative properties. The Arabs and Turks use great quantities of coffee. They prepare it very hot, and drink it without sugar at all periods of the day. The Mohammedans in India are also great coffee drinkers. They think that it allays nervous irritability, and prescribe it in cholera. The French use more coffee than the British; their coffee too is stronger, and is sometimes mixed with a large proportion of warm milk. Coffee has been a favourite beverage of many great men, Napoleon, Frederick the Great, Voltaire, and Leibnitz, were particularly fond of it. The quality of coffee is greatly dependent on the roasting; if too little done, it is heavy and has scarcely any flavour; if too much, it has a disagreeable burnt taste; whereas when the heat is properly regulated, it acquires a fine aroma, and becomes a most agreeable article of food. Coffee is frequently spoiled by being long boiled, in which case it is deprived of its fine flavour and strength, in consequence of the aromatic oil which it contains being dispelled. It is best prepared by pouring boiling water through the powdered coffee on a strainer, and various ingenious machines have been contrived for the purpose; one of the most curious of which operates on the principle of a vacuum, formed beneath the coffee to ensure the rapid passage of the boiling water through the stratum of the ground berry. By this process coffee is perfectly made, and the aroma extracted in a few seconds. Coffee ought to be used immediately after it has been roasted and ground.

The coffee trade has increased much of late, and a large amount of capital is employed in its production and transport. The consumption of coffee in Britain has increased greatly, more especially since the reduction of the duty in 1825. At present the duty charged is sixpence per pound on British Plantation, nine-pence on East India, and one shilling and three-pence on foreign coffee. In the year ending January 1831, the quantity imported into this country was 40,952,163 lbs., and the quantity exported, 28,087,994 lbs. The chief countries from which coffee is imported are, Arabia, Java, Sumatra, Brazil, and the West India islands. The quantity annually supplied by Arabia is said to be 14,000,000 pounds. The consumption of coffee over the world is thus stated:—

	Tons.
Great Britain	10,000
Holland and Netherlands	40,200
Germany and the countries round the Baltic	32,000
France, Spain, Italy, Turkey in Europe, and the Levant	28,500
America	18,500
Total	129,200

Coffee is recommended medicinally as a stimulant, astringent, and antiseptic. When taken internally it diffuses a grateful warmth through the frame, soothes the system, and at the same time revives and sharpens the intellectual powers. From its property of preventing sleep, it is particularly useful to those who trim the midnight lamp. It produces all the effects of stimulating liquors, without confusing the ideas or inducing intoxication. In some peculiar constitutions it causes such a degree of irritation, accompanied with tremors and other disagreeable symptoms, that its use cannot be persevered in. When taken immediately after dinner, coffee seems to promote digestion, and it is one of the best substances for removing the disagreeable effects of opium or morphia, as well as for dissipating sick headaches arising from the previous use of stimulating liquors. In spasmodic asthma, Sir John Pringle recommended coffee without milk or sugar. Raw coffee has been used as a tonic in intermittent fevers. A decoction of it has been prescribed at Naples in chronic inflammation of the eyes, and the vapour produced during the process of roasting has also been useful in the same disease.

Coffee may be imitated by roasting rye with a few almonds. Roasted wheat and rye were lately much used by the poorer classes in Britain. In India, roasted rice has been used as a substitute for coffee; and in Europe, the roasted seeds of the common yellow water-flag have also been employed for a similar purpose.

According to MM. Robiquet and Pelletier, coffee contains a peculiar principle called caffeine, a volatile concrete oil, gum, albumen, a white sweet oil, a bitter principle, and an acrid resinous matter. During the process of roasting, tannin and a peculiar acid are developed.

Coffea Mauritiana is another species of this genus, which is found in the woods of the Isle of Bourbon. It furnishes also a kind of coffee.

Coffea Bengalensis is an erect shrub, found in Bengal, which flowers in the hot season, and yields fruit in the cold. It bears white flowers, which are succeeded by a small black berry. Its seeds are inferior in quality to those of the *Coffea Arabica*. Several other species, such as *Coffea racemosa* and *Zanguebaria*, produce seeds which may be used as coffee.

The next genus deserving notice is *Cephaelis*, containing upwards of thirty species, the most important of which is *Cephaelis ipecacuanha*. This is a perennial plant, found in the humid shady woods of Brazil, and other parts of South America, and is of great importance as furnishing a valuable article of materia medica known by the name of *Ipecacuan*. This medicine is procured from the root, which was first introduced into Europe as an emetic, towards the middle of the seventeenth century, by a physician named Legras. The plant, however, which yielded the root, was not known until Brotero, Professor of Botany in the University of Coimbra, in Portugal,

published an account of it in the Linnæan Transactions under the name of *Calicocca Ipecacuanha*. Decandolle has since discovered that the plant belongs to the genus *Cephaelis*, and has retained the specific name *Ipecacuanha*, which is the Peruvian name of the plant, and is derived from *Ipi*, signifying root, and *Cacuanha*, the name of the district where the root is procured.

There are three kinds of ipecacuan root known in commerce—the brown, or annulated; the black, or striated; and the white. The first of these, which is exported from Rio Janeiro to Portugal, is the true medicinal *Ipecacuan* of this country, and is the root of the *Cephaelis ipecacuanha*. The root of this plant is creeping, three or four inches long, compact, irregularly twisted and knotted, and about the size of a goose-quill. It is not a continuation of the underground horizontal stem, but the offsets from that part of the stem.

The black, or striated ipecacuan, is the root of the *Psychotria emetica*, a native of Peru and New Grenada, where it is much used as an emetic. It used to be exported from Carthagena to Cadiz, but is now seldom brought to Europe, as its action is much less certain than that of the brown ipecacuan. This root is not knotted like that of the *Cephaelis*.

Another root, under the name of white ipecacuan, is sometimes introduced into commerce. This is the product of a totally different plant, *Richardsonia Braziliensis*, and is known in Brazil under the name of *Poaia Crauca*. It has a pale whitish colour, a nauseous odour, and a very acrid taste. The roots of various species of *Cynanchum*, *Viola*, *Ionidium*, and *Euphorbia*, are also imported under the general name of ipecacuan, and mixed with the root of the true species. They all possess emetic properties in a greater or less degree.

By recent analysis, it has been ascertained that the properties of ipecacuan are owing to the presence of an alkaline substance, to which the name of *emetin*, or *emetia*, has been given. In the brown ipecacuan, there are sixteen parts of this substance in the hundred; in the striated, fourteen; and in the white, only five or six. Besides emetin, the true ipecacuan contains oily or fatty matter, wax, gum, starch, gallic acid, and woody fibre. Emetin exists almost entirely in the inner ligneous, and not in the outer or cortical part of the root. The mode of procuring emetin is as follows:—Separate all soluble matter from the powdered root of ipecacuan by cold water; evaporate the solution to a certain degree in a water bath; add sub-carbonate of magnesia in excess, and afterwards evaporate to dryness; then add strong alcohol, which dissolves the emetin and resin; evaporate this tincture to the consistence of an extract; dissolve in water and again evaporate. In this way emetin is procured, mixed with some impurities. It presents the form of brown semi-transparent scales, having a bitter acrid taste.

Another mode of preparation is, by first adding ether to the powder of ipecacuan, in order to dissolve the fatty matter; then boiling the resin which remains in alcohol, and afterwards treating it with magnesia. By this means emetin is thrown down, which may be dissolved in alcohol, and then evaporated, so as to obtain crystals.

In order to purify emetin, add an acid, and then an alkali, mix with animal charcoal, dissolve in alcohol, and evaporate.

When obtained in a pure state emetin is a white

pulverulent, alkaline substance, scarcely soluble in cold water, soluble in alcohol, and not in ether. In doses of a grain to three grains it produces copious vomiting, and it has been distinctly proved to be the active principle of ipecacuan.

Ipecacuan has been much employed in medicine, and has been exhibited in the form of powder, infusion and wine. Its chief use is as an emetic, for which purpose twenty or thirty grains of the powder, and from half an ounce to an ounce of the wine, are usually given to adults. In small doses ipecacuan produces sickness, and acts as a gentle laxative, while in still smaller doses it stimulates the stomach and promotes digestion.

As an emetic ipecacuan is preferable to common tartar emetic in cases where vomiting is to be produced at the same time that the stomach is to be strengthened in a certain degree, and also in cases where any bowel complaint exists.

Emetin acts more rapidly than ipecacuan in producing vomiting, and its effect is generally followed by sweating and a tendency to sleep. Ipecacuan is also used to produce sweating, more especially when combined with opium, constituting the powder commonly known by the name of Dover's powder. As an expectorant it is also frequently employed, and lozenges are made of it which are useful in coughs and catarrhs. A full dose of ipecacuan sometimes checks an accession of fever, and is useful in inflammatory eruptive diseases. In nervous diseases, bowel complaints, and cases of poisoning, the powers of this medicine are often called into action. Ipecacuan loses much by keeping, especially when exposed to light.

The genus *Psychotria* contains nearly 180 species, some of which deserve to be noticed. They are chiefly West Indian plants, bearing white flowers, and sometimes exhibiting a very beautiful foliage. *Psychotria emetica* has been already alluded to as furnishing the black or striated variety of ipecacuan.

The root of this plant differs from that of the *cephaelis*, in its cylindrical form, and in having contractions or strangulations at moderate distances with intervening striated spaces. *Psychotria herbacea* also supplies a root having emetic properties. The seeds of this species are used by the negroes in Jamaica instead of coffee. *Psychotria noxia* is accounted poisonous in Brazil. *Psychotria nitida* has received the specific name of *Mapouria*, because the mapouris, or wild cows in Guiana, feed on its leaves and branches. *Psychotria involucrata* is aromatic when dried or bruised, and an infusion of its leaves is used in asthma. One of the species, *Psychotria parasitica* is found growing as a parasite on the trees in the West Indies.

The genus *Exostemma* has been separated from cinchona in consequence of the corolla being smooth and the stamens projecting beyond it. It contains nineteen species, most of which grow in the islands of the Gulf of Mexico and on the American continent. *Exostemma caribæum* and *floribundum* yield bitter barks, which are sometimes mixed with the true cinchona. By analysis the bark of the latter species is found not to contain any trace of quinia, or cinchonina.

Rondelctia febrifuga yields a fever bark which is used at Sierra Leone, and barks of a similar kind are furnished by *Portlandia hexandra*, *Macrocnemum corymbosum*, *cuspidatum* and *australe*, *Guettarda coccinea* and *Coutarea hexandra*. *Portlandia grandiflora*, a

native of North America, yields a bark, called *Quina nova*, which is said to possess febrifuge properties.

Chiococca racemosa is a creeping shrub, like jessamine, the root of which is known in Brazil by the name of Cainca. This root is met with in commerce under the form of rounded pieces two or three feet long, the thickness of a writing quill, and striated so as to resemble the root of *Psychotria emetica*. According to analysis the root yields a substance analogous to emetin, which seems to be its active principle, and has been denominated *caincique* by the French. The root is used as a cure for the bite of poisonous serpents, and from its purgative properties is administered in dropsies and visceral obstructions.

Nauclea or *Uncaria Gambir* yields a lightish, brown, bitter, and very astringent extract, called *Gambir* or bastard catechu, which consists almost entirely of gallic acid and tannin. It is obtained at Malacca by boiling the leaves of the plant, and is used by the Malays as an astringent. It is also chewed by them along with the betel-leaves.

The bark and root of *Antirhoa verticillata* are used in the Isle of Bourbon for checking hæmorrhage. *Richardsonea rosea* and *emetica*, *Manettia cordifolia*, and *Spermacece ferruginea* and *poaya* furnish emetic roots. The bark of the roots of *Morinda umbellata* and *citrifolia* is used in the East Indies for dyeing red and brown. The leaves of the former species are combined with aromatics in cases of diarrhœa. *Morinda royoc* is used in dyeing and in making ink. *Hedyotis umbellata* is used in India for dyeing nankeen. *Webera tetrandria* is a thorny bush met with on the Coromandel coast bearing a reddish brown edible fruit, the size of a small bramble. A decoction of the leaves and root is used in India in dysentery and in cases of worms: the leaves are sometimes put into curries. The leaves of *Oldenlandia umbellata* are considered by the Indian doctors as expectorant, and are used in asthma. They are used in cutaneous diseases, and for the cure of poisonous bites. The root is employed at Masulipatam for dyeing cotton red. *Gardenia florida* is highly odorous, and is made into hedges in Japan. Its seeds dye yellow. *Gardenia Rothmanna* is chiefly fragrant during the night. The fruit of *Gardenia dumetorum*, when ripe, looks like a small yellow apple. It encloses numerous strong-smelling seeds which, when bruised, have the property of intoxicating fishes. The fruit, when powdered, acts an emetic, and the bark of the root is used as an astringent.

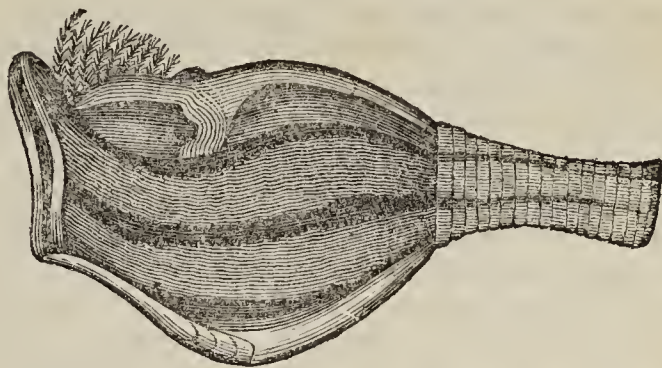
Genipa Americana bears an esculent fruit which is much esteemed in Dutch Guiana. *Sarcocephalus esculentus* yields a high flavoured fruit, which has the appearance of a pine apple without a crown. Several species of *Gardenia* also yield succulent fruits which are used as food.

Ixora pavetta is valued by the Hindoos on account of the beauty of its flowers. Its fruit is green, and is often employed as a pickle. The genus *Siderodendron* receives its name from the hardness of its wood, which is said to resemble iron. In the species of this genus the corolla is often changed by an insect into an oblong bag, half an inch in length, fleshy and hollow within, and ending in a point at the top. *Pinckneya pubens*, genga bark, is a low tree of the United States, having a soft wood and bitter inner bark, which has been used successfully in the cure of intermittent fever.

We have thus given an extended view of the natu-

ral family of Cinchonaceæ which forms so important a part of the vegetable kingdom. In whatever way we regard this family, whether as furnishing remedies which have contributed in no small degree to alleviate the sufferings of humanity, or as supplying some of the most valuable luxuries and necessities of life, we must allow that it well merits attention, and occupies a high place among the numerous vegetable tribes which are scattered over the surface of the globe.

CINARAS (Leach). The genus *Gymnolepas* of Cuvier. This shell consists of five narrow valves, so widely placed that they do not cover the whole of the animal; to compensate for which they are enclosed in a membranous bag, a continuation of which forms the peduncle; it is of a greenish colour, with six longitudinal black stripes, three on each side; it has an anterior opening for the passage of the animal's



tentacula or arms. First class of the sub-type *Hematomopoda*, first family *Lepadicea*, of Blainville's system. The *Cinaras Cranchii* is here figured.

CINDUS. See DIPPER.

CINERARIA (Linnæus). A very numerous genus of herbs, undershrubs, and shrubs found in almost every part of the globe. Linnæan class and order *Syngenesia superflua*; and natural order *Compositæ*. Generic character: anthodium simple, and in many parts; receptacle naked; pappus roughly pilose. The cinerarias are all pretty flowering plants, some of them singularly beautiful, and well worth cultivation. The undershrubby species are easily propagated by cuttings, and the herbaceous sorts by division of the roots.

CINNABAR. This name is given to two very different minerals, which in their external appearance nearly resemble each other. The dark red cinnabar occurs massive, disseminated, and in flakes and crystallised. Its primitive form appears to be a rhomboid, and by attrition it yields a scarlet-red streak.

Bright red cinnabar, or native vermilion, occurs in small quantities in beds and veins; in the latter, it is found in considerable quantities in Bohemia. Asia also produces this mineral, but South America may be considered as the principal source whence it is derived for commercial purposes. Cinnabar occurs in considerable quantity in the province of Antioquia, in the Valle de Santa Rosa, east from the Rio Canca; in the mountain of Quindiu, in the pass of the central Cordillera, between Ibague and Carthago, at the extremity of the ravine of Vermellon: and in the province of Quito, between the village of Azogue and Cuenca. The cinnabar is not only found in round fragments, mixed with small grains of gold, in the alluvial soil with which the ravine de Vermellon, at the foot of the table-land of Ibague Viejo, is filled, but the miners know the vein also from which the torrent appears to have detached these fragments, and which traverses the small ravine of Santa Anna. Near the village of Azogue, to the north-west of

Cuenca, the mercury is found, as in the department of Mont Tonnerre, in a formation of quartz sandstone, with a clay base or cement. This sandstone is nearly 4592 feet in thickness, and contains bituminous wood and mineral pitch.

Compact hepatic cinnabar has a colour between dark cochineal-red and lead-grey. In its chemical constituents it differs very materially from the mineral last described; as, in addition to the mercury and sulphur found in those bodies, there is usually a considerable quantity of carbon, combined with silica, alumina, oxide of iron, copper, and water.

Cinnabar is distinguished from red silver by the red streak it affords on paper, and also in being entirely volatilised when heated; from red orpiment, by the colour of its streak, that of red orpiment being orange yellow; and from red leadspar, also by the streak, that of the lead ore being lemon-yellow.

It appears from some of the ancient naturalists, that the term Minium was derived from the name of a river of Spain; and there are several passages in Pliny, which show that the term "minium" was applied to a corresponding substance with our cinnabar. He says, that almost all the minium in use at Rome came from Spain, and that the ore was sent over from Spain sealed. He also says, that those who were employed in reducing minium to powder, wore loose bladders over the face, lest they should inhale the dust, the effects of which were very pernicious. This custom is also observed at the present day, by those who are employed for a length of time in triturating preparations of mercury. The term cinnabar was originally applied to the drug commonly called dragon's blood, which is of a dull red colour; it was afterwards transferred to the ore of mercury now under consideration. See MERCURY and SILVER.

CINNAMOMUM (R. Brown). A new genus of useful and beautiful evergreen exotic trees separated from the old genus *Laurus* of Linnæus. It contains the *true*, and the *base* cinnamon; the camphor tree, and six others having botanical distinctions, which show their non-affinity with the laurels. They are kept in our stoves but require much attention to keep them healthy. They must be kept in a pretty high temperature; not over watered in winter, and at all times, their pots require to be well drained, lest the soil with which they are potted become soddened. They are propagated by ripened cuttings, having their leaves on, potted in sand, and covered with a striking-glass on heat.

CINNAMON-TREE is the *Cinnamomum verum* of R. Brown, formerly the *Laurus cinnamomum* of Linnæus. This is the tree which yields the spice so called. There are eleven other species of it distributed over the islands and south east corner of the continent of Asia. Some of them are found in Japan, and most of them in the southern provinces of China. But it is on the islands of Borneo, Java, Sumatra, &c., and as far west as the island of Ceylon, that the true cinnamon tree is found, and the spice of finest quality manufactured. It is obtained from the young shoots and branches of the tree, which are about half an inch, more or less, in diameter. The united layers of inner bark, between the cuticle and wood, is the part collected; and as, when longitudinally incised from top to bottom, it shrinks spontaneously away from the wood by the heat of the sun; it is of course, easily collected and sorted for sale. The inner bark of the *C. cassia* is collected in the same way and sold as a

distinct article of commerce; but this, and the inner bark of several of the other species are too often mixed with, and sold as the true sort.

CINQUEFOIL is the *Potentilla fruticosa* of Linnæus, a British plant, found on moist boggy places in different parts of the country. Its flowers are yellow, and rather showy, for which it is sometimes admitted as a shrubby plant in pleasure grounds. Cinquefoil belongs to the natural order *Rosaceæ*.

CIONUS (Clairville). A genus of colcopterous insects, belonging to the section *Tetramera*, subsection *Rhyncophora*, and family *Curculionidæ*, or the Weevils. The species of which this genus is composed, although small in size, are very beautiful in their appearance, being nearly globose in form, with a moderately long curved snout; the thighs are thickened and dentated beneath, and the antennæ are ten jointed, and elbowed at the extremity of the long basal joint; the elytra are ornamented with alternate stripes, having the appearance of tessellated work. The species are found in the different states upon various plants, particularly the water betony. The type of the genus is the *Curculio scrophulariæ* of Linnæus; it is nearly one-fourth of an inch long, the larvæ of which is covered with slime, which enables it, being unprovided with legs, to walk steadily upon the leaves by the mere lengthening and contracting the segments of the body. There are five other British species.

CIRCÆA (Linnæus). A genus of three species of plants, two of them British. They belong to the second class and second order of Linnæan botany, and to the natural order *Onagrariæ*. The *C. lutetiana* inhabits damp shady places, and is sometimes a troublesome weed in shrubberies. It is the enchanter's nightshade of English botany.

CIRCÆACEÆ. The enchanter's nightshade family. A natural order of dicotyledonous plants, containing two genera and twelve known species. It is nearly allied to *Onagrariæ*, but differs in having a large fleshy disk, which fills up the tube of the calyx, as well as in the binary division of its flower, and in its solitary erect ovules. By some authors, however, it is considered a section of *Onagrariæ*. It bears also an affinity to the order *Haloragææ*. Its essential characters are: calyx superior, tubular, with a two-parted limb; petals two, alternate with the lobes of the calyx; stamens two, alternate with the petals, inserted into the calyx; disk large, cup-shaped, filling up the tube of the calyx, and projecting beyond it; ovary two-celled, with an erect ovule in each cell; style simple; stigma emarginate; fruit capsular, two-celled, two-valved, and two-seeded; seeds solitary, erect; no albumen. The plants belonging to this order are herbs or shrubs, with opposite, petiolate, cordate, or ovate leaves, and racemose flowers. They are found in shady places in the northern parts of the world. They do not possess any known properties. The only genera of the order are *Circæa* and *Lopezia*.

Circæa is named after the enchantress Circe, from its supposed use in incantations. It contains three species, two of which are natives of Britain. *Circæa lutetiana*, common enchanter's nightshade, is frequently met with in our woods, and is also found in the woods of Canada and Nepal. *Circæa alpina* grows in wood and stony places, near the side of lakes, in the north of England and Scotland.

The genus *Lopezia* has been named in honour of the Spanish botanist, Lopez.

The various species are chiefly elegant annuals, some of which are cultivated in gardens.

CIRCELLIUM (Latreille.) A genus of coleopterous insects belonging to the section *Pentamera*, sub-section *Lamellicornes*, and to the family *Scarabidæ*. The body is hemispheric, convex, and with the abdomen nearly semicircular, the lateral margins of the thorax are not produced into an angle in the centre; the scutellum is merely rudimental; the shield of the head is cut, at its anterior margin, into several teeth. The type of this genus is the *Ateuchus Bacchus* of Fabricius, an inhabitant of the Cape of Good Hope, an insect nearly allied to the sacred beetle of the sun, worshipped by the Egyptians, and of which a representation may be seen on the outside of the Egyptian hall in Piccadilly.—The new species of this genus which we have figured in our plate of Beetles, is contained in the extensive collection of the Rev. F. W. Hope, president of the entomological society, whose museum is opened with the greatest liberality to the student; to whom we beg to return our thanks for the loan of this and the other new and very rare species figured in our plate; and by whom the insect of the present genus has been named *Circellium Lyceus* (one of the names of Bacchus) in allusion to its close affinity to the *Circ. Bacehus*, from which it differs in its large size, and in the different form and appearance of the teeth of the clypeus. It is an inhabitant of Sierra Leone and has not been previously described.

CIRRHÆA (R. Brown). A curious little plant, introduced from China, formerly called *Cymbidium* in the Botanical Cabinet of Loddiges. It is a gynandrious plant, and belongs to the natural order *Orchideæ*.

CIRRHIBARBUS, a genus of spinous-finned fishes, belonging to the family of *Gobioides*, and nearly related to the blennies. The characters are: the teeth in many rows, and closely set; a small tubercle over each eye, and each nostril; three large fleshy barbs on the point of the muzzle, and eight on that of the lower jaw. There is but one known species; it is a native of the Indian seas, and all over of one uniform yellow colour.

CIRRHINES. A genus of soft-finned fishes, with abdominal fins, belonging to the carp family; having some resemblance to the gudgeon, but with more elevated dorsal fins, and long filaments at the middle of the upper lip. There are two known species, both Indian.

CIRRHITES. A genus of spinous-finned fishes, belonging to the perch family. They have crooked teeth, one dorsal fin, the gill-flap toothed, the gill-lid with a soft flap; the last rays of their pectoral fins are thick and not divided. There are several species of them, all inhabitants of the Indian seas.

CIRRHOBANCHIATA (Blainville). A mollusc having the organs of respiration in the form of numerous long filaments, supported by two radical lobes above the neck. Shell sub-tubular, rather conical throughout its whole length, and open at both extremities. Second class, *Paracephalophora*; 5th order, *Nucleobranchiata*.

CIRSIUM (Vaillant). A very extensive genus of herbaceous plants, chiefly European. Linnæan class and order, *Syngenesia Æqualis*; and natural order *Compositæ*. Generic character: scales of the anthodium spinous; receptacle dry and bristly; pappus sitting and deciduous. So numerous are the species of this genus, that botanists have divided them into

seven sections, the more easily to study and arrange them in herbariums. Before this was done, many of the species were supposed to belong to the genera *Cnicus*, *Carduus*, *Serratula*, &c. They are a tribe much more interesting to the botanist than to either the florist or the general lover of plants: their hostile thistly appearance renders them unenviable.

CIS (Latreille). A genus of coleopterous insects of doubtful situation, and comprising about a dozen British species of small size, having the body of an ovate-oblong form, convex above; the antennæ are short, and terminated by a three-jointed club, the joints not being soldered together as in the *Bostrichidæ*; the tarsi are composed of four joints, the last of which is longer than the rest united. The species are found in boleti, in which also the larvæ reside. It has been considered nearly allied to the death watches (*Anobium*), whilst Latreille placed it widely apart amongst his *Xylophaga*. The type of the genus is the *Anobium boleti* of Fabricius, of a chesnut colour, with the legs and antennæ lighter coloured. Its length is about one-sixth of an inch. It is found very abundantly during the summer. This genus may, be instanced as containing some of the obscure but not less available agents in supporting the great harmonies of nature. The boleti are the natural results of putrefying vegetable matter, and the species of the present genus materially assist in again turning to decay the decay-loving boletus.

CISSAMPÉLOS (Linnæus). A genus of hot-house and greenhouse climbers, natives of different and warmer parts of the world. They are diœcious, and belong to the natural order *Menispermaceæ*. Those in our collections are easily increased by cuttings.

CISSUS (Linnæus). A genus of evergreen tropical climbers, long inmates of our hothouses. Linnæan class and order *Tetrandria Monogynia*; and natural order *Ampelideæ*. These plants are of no great beauty, and therefore not very generally cultivated.

CISTELIDÆ, a family of coleopterous insects, belonging to the section *Heteromera*, and sub-section *Stenelytra*, nearly allied to the *Helopidæ*, from which they are distinguished by having the margin of the head not produced over the base of the antennæ, which are consequently exposed; the jaws terminate in a simple point, without any internal teeth; the claws of the tarsi are denticulated beneath. The perfect insects are found upon flowers, and amongst the leaves of various trees, and it is supposed that they pass their preparatory states in the softer wood of trees; the larva of *C. ceramoides* is found in the moist and decaying parts of oak trees.

The genera introduced by Latreille into this family (which, Mr. Stephens has united with the *Helopidæ*), are *Lystronychus*, *Cistela*, *Mycelocharlas*, and *Allecui*, to which the last named author has added another British genus *Eryx*. The species are of small, or but moderate size, not exceeding one-half or three-fourths of an inch in length.

The genus *Cistela* is distinguished by the thorax being broadest behind, nearly semicircular; the jaws entire, and the body of an oval form. There are five British species, of which the *Chrysomela ceramoides* of Linnæus may be considered as the type.

CISTINEÆ—Cistus or Rock-rose family. A natural order of dicotyledonous or exogenous plants, containing four genera, and nearly 160 known species. It is allied to the order *Violaceæ* or *Violariææ*, and was formerly confounded with it, but it differs in

its indefinite stamens, and inverted embryo. It also bears an affinity to *Bixineæ* and *Hypericineæ*, but is distinguished from these orders by its mealy albumen, the absence of dots in its leaves and the structure of its fruit.

The essential characters of the order are: sepals five, persistent, unequal, two outer ones smaller, three inner, with a twisted æstivation; petals five, caducous, equal, wrinkled in æstivation, and twisted in a direction opposite to that of the sepals; stamens indefinite, hypogynous, distinct; anthers ovate, two-celled, inserted by their base; ovary distinct, one or many-celled; style single, filiform; stigma simple; fruit a capsule, three to five-valved, occasionally ten-valved, one-celled, with the valves bearing a single longitudinal placenta, or three to five-celled, with dissepiments proceeding from the middle of the valves, and touching each other in the centre. Seeds indefinite in number.

The plants of the order are shrubs, or herbs with viscid branches, simple, opposite or alternate leaves, and racemose flowers, which are very fugacious, and are of a white, yellow, or red colour. They are chiefly found in the south of Europe and north of Africa. A few are met with in North America, while in South America and Asia the order is scarcely known.

The rock-roses of our gardens give a good idea of this order, of which they form the chief part. Their properties are little known. Some of them yield a resinous substance possessing tonic and stimulant qualities. They are principally cultivated as ornamental plants on rock-work.

The genera of the order are *Cistus*, *Helianthemum*, *Hudsonia* and *Lecha*. The two latter are exclusively North American genera.

The genus *Cistus* gives name to the order, and is derived from a Greek word, signifying a box or capsule, on account of the peculiarity of its seed-vessel. There are twenty-eight species of *cistus*, most of which are showy plants, flowering freely. *Cistus creticus* is an elegant shrub, which grows in dry rocky places in the island of Crete, in Syria, and in several parts of the Archipelago. It was first cultivated in England in 1731. Its flowers, which are of a beautiful purple colour, open at sun-rise, follow that luminary in its course, and fall off in the course of the evening. From this species, as well as from *Cistus ladanifer*, *laurifolius*, &c., there is collected in the east a resinous matter known by the name of *ladanum* or *labdanum*. This substance is procured by drawing lightly over the shrub a kind of rake to which leathern thongs are attached in place of teeth. By this means the unctuous juice which covers the plant is collected, and is afterwards scraped off with a knife. There are two kinds of *ladanum* met with in commerce, one in masses more or less voluminous, of a blackish brown colour, and soft consistence, the other in rolled pieces of a drier and harder texture. This gum-resin, when pure, exhales an agreeable balsamic odour, and has a bitter aromatic taste. When burnt it diffuses a thick white smoke, and a pleasant perfume. As it occurs in commerce it is generally impure, being mixed with other resinous substances, and with fine ferruginous sand.

Ladanum is used in France as a tonic and astringent in catarrhs, dysenteries, &c., and it enters into the composition of some stimulating plasters. It is now rarely used in medicine, and is chiefly employed in fumigations, and in the formation of various perfumes and cosmetics.

Cistus villosus has large purple flowers, which are very ephemeral, falling off the same day they expand. A succession of fresh flowers come out daily for several months.

CITRUS (Linnæus). The well-known and highly-valued orange tree. Linnæan class and order *Polyadelphia Polyandria*; and natural order *Aurantiaceæ*. Generic character: calyx pitcher-shaped, in three or five divisions; petals five, often more; stamens compressed, variously united at the base; anthers oblong; style cylindrical; stigma hemispherical; fruit a berry of many cells, pulp composed of juicy bladders; cells containing seeds. It is scarcely necessary to observe, that the various species of this genus are among the most beautiful, most fragrant, and most useful of fruit trees. The warmer parts of the temperate zone appear to be the favourite climate of the orange; but, even between the tropics, they come to great perfection, provided the station is high enough above the level of the sea.

Whether the wild lime in the jungles of India be the original stock from which all the numerous varieties of the orange have been, in the course of time, derived, is a question admitting of no certain answer. The limes in India, and other places, are exactly alike, and bear the same relation to the orange that the crabs in the woods of England bear to the apple.

The lime, lemon, orange, and shaddock, are the most remarkable of what are called species; but between the lemon and the shaddock, there are innumerable varieties called citrons, especially in Italy: and of both the lemon and orange, there are many varieties, differing in flavour, in bulk, and in shape and colour.

This fruit tree differs from all others, in bearing two crops of fruit at the same time in different stages of their growth towards perfection;—that is to say, the young fruit of this spring 1835, do not ripen till late in the autumn of 1836, and it sometimes happens that flowers appear before the ripe fruit are gathered. On this account it is that the orange tree is impatient of frost; as there is always some fruit on the tree, which would be injured by severe cold. In all countries where the orange or lemon is cultivated, and which may be subject to the least degree of frost, precautions must be taken that the trees be defended from it. In Britain, and in other northern countries of Europe, orange trees are kept either in greenhouses or conservatories, more as ornamental than as fruit trees. For the latter purpose their culture is unnecessary; seeing that the fruit are so cheaply procurable from the south of Europe. Not but that their culture to the utmost perfection is practicable in the northern latitudes, for orangeries exist in many places, where the affluent proprietors prefer plucking mature fruit from their own trees, rather than depend on the supplies from St. Michael's or the south of Spain.

As all the best varieties of the citrus tribe are truly artificial or accidental creations, they cannot be reproduced from their seed. In this respect they are exactly like our garden and orchard fruits; and, therefore, must be perpetuated by grafting or budding. The strongest stocks which can be raised from the seeds of any of the varieties are always preferred. Those from the lemon, or what is called the Madras citron, are found to be the best for the finer sorts of sweet oranges. The seeds should be sowed in the previous summer; potted off singly, as soon as possible, and forwarded so as to be ready to take the

graft in February or March. Soon as grafted, they should be placed on a dung hotbed under a glazed frame. Here, if in a proper moist temperature, the grafts will soon take, and grow away to be fine little plants by the end of summer.

Orange trees do well in tubs or boxes, in which they may be kept for many years, and until of considerable size. This is particularly convenient, where it is necessary to house the trees in winter. They require a loamy soil enriched with rotten dung; and as they do not require to be often shifted, top-dressings of sheep or cow dung are given on the top of the soil in the pots or boxes.

Where houses are built expressly for the purpose of fruiting orange trees in this country, the trees are trained to a trellis against the back wall, planted as standards along the middle, and as many kept in boxes as will fill every part of the house. The temperature of the house should be regulated according to that of the season; never lower than 45° in winter nights, and about 60° after sunset in summer. At all seasons they should have as much fresh air as possible, so as it is not too chilly; and sprinkling frequently with tepid water is of service to free from dust and discourage insects, to which orange trees are very subject. One species of coccus is a common pest; and after it has formed its scale to breed under, cannot be displaced without using the back of a knife, or sharp point of a stick. Indeed a stick pointed at one end, and a bit of sponge fixed to the other, must be frequently used to keep the trees clean.

One very important part of the management of orange trees, in order to have large and well-flavoured fruit, is the timely thinning the flowers and fruit, after the latter are fairly set. The tree is naturally extremely fruitful, and if neither flowers or fruit are mercifully thinned, the tree becomes stunted, and will neither produce healthy shoots nor sizeable fruit. The supernumerary flowers are saleable, and fetch a high price among perfumers. In the neighbourhood of Paris vast numbers of orange trees are cultivated for their flowers only; and in this country there cannot be a more agreeable ornament than an orange tree, while in flower, placed in the entrance hall of a mansion.

The shaddock, or pommelmoc, as it is called by the Portuguese, is the largest, both as to size of tree and fruit, of any of the tribe. In India, when seen loaded with fruit nearly ripe, it is certainly a magnificent object: the deep green glossy foliage, forming a dense background to the large bright yellow fruit scattered over the exterior of the branches. A full-sized fruit is not less than five inches in diameter; and, though less juicy and more acid than the orange, it is much sweeter and less acid than either the lemon or the lime. The shaddock is a dessert fruit; and so loosely are the vesicles composing the pulp attached to each other, that they are separated by the fingers, and may be eaten singly like grapes. Their qualities are considered anti-scorbutic; and homeward-bound European ships usually lay in a store of them with which to proceed on the voyage; they, however, require to be suspended singly in net bags, as they do not keep long if laid together in a locker. The lime in its wild state is, when young, a very prickly, rigid looking shrub; but becomes almost or wholly spineless when old, or when domesticated. Its juice, however, is, perhaps, superior to all others for medical and culinary purposes.

The Chinese, who may be called a nation of gardeners, possess many varieties of the citrus, and especially some excellent oranges. Their mandarin variety is a very superior fruit, and has the singular property of discharging the rind from the pulp when fully ripe. These oranges are very plentiful, and may be purchased very cheap in the streets of Canton in the season (spring), provided the seller be allowed to strip the fruit and retain the rinds, of which they make some specific use. There are also several varieties, differing in the size and flavour of fruit, manner of growth, size of leaves, &c., many of which are already in European collections.

CIVET—*Viverra*. A genus of carnivorous mammalia, placed by Cuvier last in that division of digitigrade carnivora, of which the dog may be regarded as the type; and intermediate between the foxes and hyænas in the system. They have three false grinders on each side of the upper jaw and four in the under, the front ones of which are sometimes shed. There are two moderately large tuberculous grinders above, only one below, and two projecting tubercles on the interior side of their foremost carnivorous tooth below. All the rest of the grinders have their crowns more or less tuberculous. The tongue is beset with horny papillæ, harder and more pointed than in the hyænas, but not so much so as in the cats. With the exception of one of the sub-genera, there are five toes on all the feet, the claws on which are sharp and more or less retractile, but they are not very crooked. The legs are generally short in proportion to the length of the body; and the greater number use the elasticity of the arched spine to aid them in springing on their prey. Under the tail there is a scent bag, which secretes an unctuous matter, which is, in some of the species, rather abundant, has a strong musky scent, is much valued as a perfume by the Orientals, and once formed an article in the materia medica of Europe, under the name of *civet*. It is now excluded from the list of medicines; and it got a place in that list formerly, probably for no better reason than the old dogma, that "whatever seemed to have active qualities, and for which no other use could be found, must have been intended for curing some disease." In addition to this matter, of which the scent, when it has any, is generally musky, there are, at least in some of the species, two smaller openings, situated in the same part of the body, from which a dark-coloured fluid of a very disagreeable scent is discharged.

When we consider the appearance, the structure, and the habits of these animals, we find it somewhat difficult to determine to which of the other families they have the nearest resemblance. In their general form, their style of walking, and also in the possession of the anal scent bag, they bear no inconsiderable resemblance to the pole-cat or martin family; many of them have also much of the air and not a little of the manners of the hyænas; some of them also have slightly the appearance, and all have a good deal of the manners of the smaller cats; they also, in their form, the feet excepted, bear some slight resemblance to the badgers; nor is it impossible to trace points of resemblance between them and the dogs. But still they have a distinctive character of their own; and though the different sub-genera and species vary a good deal from each other, it is easy to trace a family likeness among them all. But it is much more easy to trace this likeness than to say in words in

what it consists, because it is a likeness of the whole character of the animals as made up of structure, disposition, and habit, rather than of any one of the elements which form that character.

They are all nocturnal animals ; their eyes close to a vertical line in the pupil, like those of the common cat, and, as is the case with that animal, they all glisten in dull light. Some account of this glistening of the eyes of nocturnal animals may be found in the article *CAT* ; and we may here add, that the reason why the eyes of the same animals do not glisten in bright daylight, is the necessary contraction of the aperture of the pupil by the action of the light upon it. In this case, the quantity of light which gets admission to the eye is very small ; and therefore the portion of it which the eye reflects, is not equal to that reflected by objects illuminated in the common way ; but when the animal is under the shade, if that shade is moderately obscure, the eyes glisten just as much during the day as during the night.

Animals of this genus are not entirely carnivorous, but can, when necessity urges them to it, feed upon vegetable matter, of which they prefer sweet and succulent fruits. Their proper food, however, may be regarded as being animal much more than vegetable, because the carnivorous character not only predominates in their teeth, but is more strongly marked in them than in any animals except the hyænas and cats. They are very expert in catching birds, upon which they spring much in the same manner as cats do ; they also catch mice and other small animals with much dexterity, and in some parts of the world some of the species are kept in houses for this purpose. They have, however, other habits in their feeding, different from those of cats, for they are great destroyers of eggs. During the day, the greater number of them are exceedingly indolent, and sleep almost the whole of their time. Others, however, are more of diurnal animals, and follow at least some of their prey by coursing. They are all animals of tropical countries, or at least of countries bordering on the tropics ; they are wholly natives of the eastern continent and the adjacent islands. There is not above one species met with in any part of Europe, and that species is confined to the warmer parts of the south, and is far from being numerous there. Africa, India, and the Oriental isles, more especially the latter, are their head quarters, and it does not appear that a single species has been met with in Australia, or in the remote isles of the Pacific. From their indolent habits, and their short legs, they cannot be expected to migrate far in quest of food, and therefore they need hardly be looked for in places which are subject to seasonal barrenness. They are not aquatic animals, however, but frequent the banks of streams, the wood-lands, or the open glades, preying generally upon the smaller reptiles and the eggs of the larger in the first of those places, on birds and small quadrupeds in the second, and on the smaller lizards in the third. They are usually divided into three sub-genera—*Civets*, *Gennets*, and *Ichneumons*, and perhaps there are some other sub-genera which may be added.

CIVETS. These have the scent bag large and deep, divided into two cavities, and producing abundantly the unctuous substance, which has a more musky scent in this genus than in perhaps any other. There are at least two principal species,

the civet and the zibeth, which names have, however, exactly the same meaning, though the animals differ. The civet is found chiefly in Africa, and in the south-west of Asia ; the other species in the south-east ; and it is probable that there are several varieties of the latter.

Civet. This animal is often in common language styled “the civet cat,” but the name is of course inapplicable, except in some slight resemblance in the manners, in the fur on the body, and in the form of the tail.



Civet.

This species measures about two feet three or two feet four from the muzzle to the tail, and it stands from ten inches to a foot in height at the shoulder. Its muzzle is produced and pointed, but not quite so much so as the fox ; the ears are short and round ; the hair on the body is long and coarse, and that which ranges along the line of the back and the upper part of the tail, forms a sort of crest, which is turned back towards the neck ; the ground colour is bright brownish grey, with various spots and bands of blackish brown, and the dorsal crest of the same colour ; the head is whitish, with the exception of a spot round the eyes ; the cheeks and chin are brown ; the naked part of their nose is black ; the legs and under part of the tail are brown, the hair on the former especially being much shorter than that on the body ; the tail on the upper part is partially annulated.

The most remarkable peculiarity in the anatomy of the civet, is the organisation of the bag containing its peculiar scent. It opens externally by a narrow cleft, situated between the anus and the parts of generation, and is exactly similar in both sexes, which renders their apparent difference but trifling. This cleft conducts into two cavities, which might each of them contain an almond. Their internal surface is slightly covered with fine hair, and pierced with many holes, each of which conducts into an oval follicle of very slight depth, the concave surface of which is again pierced with innumerable pores. The odoriferous substance comes from these pores. It fills the follicle, and when this is compressed, it proceeds from it something in form like vermicelli, and enters the larger bag. All these follicles are enveloped by a membranous tunic, which receives many of the sanguineous vessels ; and this tunic, in its turn, is covered by a muscle which comes from the pubis, and has the power of compressing all the follicles, and with them the entire bag to which they

are attached. By means of this compression, the animal gets rid of the superfluous part of its perfume. Besides this odoriferous matter, there is another secreted, which assumes the form of stiff silken threads, and is mingled with the first. The civet has besides a small hole on each side of the anus, from which a blackish and very foetid liquid issues.

The odoriferous substance produced by the civet, and to which the animal owes its common name, forms, especially in the east, an object of considerable commerce. Its virtues are greatly vaunted, according to Baron Cuvier, among the French, though, as we have already said, its medicinal reputation is now wholly exploded.

The tail of the civet is composed of twenty-five vertebræ, which forms a difference between it and the zibeth, which has only twenty-two. We must not confound the sluggishness of this animal during the day, with incapacity of motion, at those times when its habits require it to move; for this sluggishness by day is common to all animals which prey by night; and those which pursue their prey with the greatest ardour and success, are generally the most quiet during the periods of their repose. The civet is lithe and agile, and capable either of springing like a cat, or of coursing its prey like a dog, and it indiscriminately catches birds and small quadrupeds. Failing these, it attacks fruits, and also the fleshy roots of plants. They inhabit plains and hills which are rather dry, and seldom drink. In many places of Africa they are kept and bred in a domestic state for the sake of their perfume, which still forms a considerable article of trade. The female has four mammæ, but seldom produces more than two or three young. The period of gestation has not been well ascertained.

Zibeth. This species is much smaller in size than the civet, and smoother in its covering; but it is longer on the legs. Its length is about fifteen inches exclusive of the tail, and its height about a foot. It has no crest of prominent hairs along the ridge of the back; the ground colour of its fur is yellowish grey, marked with numerous black spots, which sometimes run so much into each other, as to form nearly continuous lines along the sides. The tail is black above throughout its whole length, and pale grey on the under side, which is also the colour of the belly. The sides of the tail are marked with cross bars of black and grey; the throat and breast are white, and so are the ears, a small spot in front of the eye, and the sides of the upper lip. The throat and breast are whitish, but marked on the sides with a very conspicuous arch of black, proceeding from the hind part of the ear, and returning to the breast, but not meeting there, so as to form a complete collar. Within the arch there is a spot in the shape of the letter V, with its point directed towards the ear.

This animal is most plentiful in the Eastern islands, where it is often kept in a domestic state, in the same manner as the civet is in Africa. When fed properly it is a very peaceful animal; though it is strongly made and very active when in a state of nature.

It is probable that two distinct varieties, if not species, of these animals, both natives of the Eastern islands, have been mixed up in the descriptions of this one. This species is called *Tauggalung* by the Malays, and the other is called *Rasse*, the latter being by far the more slender of the two, and having the line on the forehead straight, the muzzle more pointed, the head and neck much smaller, and the ears much

nearer to each other. It is a very active animal, very difficult to be tamed; will not breed in confinement, and therefore, in order to procure its perfume, which is highly prized in the east, it has to be captured and confined in a cage. It is probable that there are other varieties, or even species, besides these, but their history is obscure; and, as the colours are known to be variable in the same species, and as they all have the same structure, and nearly the same habits, the distinctions of them are of minor importance.

GENNETS. These have the sac in which the scented matter is produced much smaller than the civets, and though they have the musky smell, there is no visible secretion, at least in any sensible quantity. The pupil of their eyes contracts more completely to a vertical line in the light than that of the civets, and their claws are more retractile, nearly as much so, in fact, as those of the cats, only they are not so much crooked, and the paw is not so well adapted for being either a striking or a clutching weapon.

Common Gennet. In its general appearance, the gennet bears no inconsiderable resemblance to the common pole cat, only it is rather longer and stouter, has the line of the forehead straighter, the muzzle much thinner, the ears larger and more naked, the feet stouter and the tail longer. It is covered with two sorts of hair, the longest about half an inch in length on the body, and a whole inch on the tail. The tips of the hairs are, in some places, black, others grey, and others reddish, and the tail is marked with fifteen rings, alternately white and black, with some cloudings of red.

This is a western animal, having a very considerable range in latitude, namely, from the south of France to the extremity of Africa. They sleep, or doze in indolence, during the greater part of the day, but are particularly alive during the night. They have many of the habits of cats, and are sometimes employed as substitutes. They breed in confinement, and the period of gestation is understood to be about four months.

Many other species of this sub-genus have been described, and it is probable that the *Rasse* of the Eastern isles should have been included in the number; but the history of the greater part of them is perfectly obscure, and therefore, not adapted for popular purposes.

ICHNEUMONS. These have the anal bag large and simple, with the anus in the middle of it. They have the hair short on the head and the feet, the toes semi-palmated, and they are generally found near the banks of rivers.

Common Ichneumon. Many marvellous stories have been told of the blessing which the ichneumon bestows upon Egypt, in the destruction of crocodiles and serpents on the banks of the Nile. A little more accurate information has, however, taught us to believe that the crocodile is by no means a dangerous neighbour to the human inhabitants of Egypt, neither are the serpents on the banks of the Egyptian river very remarkable for their deadly qualities; and, therefore, the ichneumon has lost much of its celebrity; and in the service which it renders to man, it must take its station below the domestic cat, though it is sometimes used as a substitute for that animal. The ichneumon is rather of a timid disposition, except against mice and small lizards; and, though it attacks the eggs of the crocodile and of other large reptiles with great courage, or, at any rate, avidity, there is no

authenticated instance of its having ventured within reach of the jaws of the crocodile. The ichneumon is not so indolent during the day as the other subgenera, and therefore it has more attraction as a domestic quadruped. It is easily tamed, remains willingly in a state of domestication, and not only obeys the call, but readily follows the footsteps of those who are kind to it.

It is rather a small animal, about fifteen inches in length and eight in height. Its colour is deep brown, so mottled with dull white, and sometimes with grey, that it is not easily described. There are five toes on each foot, the thumb is very short and apparently useless. All these toes are armed with strong and crooked claws. The sole is naked and covered with a very fine delicate skin. The eye has a long transversal pupil, but no other particular character. The nose passes the lower jaw, but is not moveable.

When the overflowing of the Nile drives the wild ichneumons from the banks, they sometimes resort to the towns and villages, to levy contributions on the poultry yards and pigeon houses (pigeons are exceedingly abundant all along the banks of the Nile), or to join in the labours of scavengery with the foxes and hyænas; but these animals not only take the lion's share of the offal, but very frequently include the ichneumon itself in that devoted portion.

The described members of this sub-genus are still more numerous than those of the former, but they are subject to the same uncertainty. Their haunts and habits are all so nearly alike, that any one of them serves to tell the tale of the others in every respect, save in external appearance and in locality. The places which they frequent, are, in all parts of the world, those in which there are periodical floodings of water; and the principal office which they appear to perform in the economy of nature, is that of destroying the eggs of aquatic reptiles, which are, in general, so very numerous, that if they were all to be hatched the young could not possibly find food.

CLARKIA (Pursh). A beautiful little annual, lately introduced into our flower gardens from North America. Linnæan class and order *Octandria Monogynia*; and natural order *Onagraceæ*. Generic character: calyx tubular, limb four-cleft, three of them often cohering; petals inserted in the calyx, claws with one tooth on each side, limb of three lobes; stamens alternately sterile and fertile, the latter opposite the gashes of the calyx; anthers linear, two-celled; style filiform; stigma of four lobes, somewhat like petals; capsule cylindrical, furrowed, and four-celled. This plant was hailed on its first appearance, not only as a stranger, but for the elegant lacinated figure and position of its petals. It readily ripens seed, which only requires to be sowed in the open borders with other hardy annuals in the spring. The original plants had purple flowers; but we have already a variety with white or very pale purple blossoms.

CLARY. Is the *Salvia sclarea* of Linnæus. This is a biennial, and cultivated for seasoning soups, &c. There are two other species of clary, viz. *Horminum*, of which there are two varieties, namely—the red and purple-topped, and *Verbenaca* the vervain-clary.

CLASSIFICATION. The productions of nature are so numerous, and the progress which the combined and continued efforts which men of all nations and in all ages have made in the knowledge of them, is so small, compared with what we are compelled to be-

lieve still remains to be known, that the life of man, measured against all that has to be learned in order to obtain even a superficial knowledge of the works of nature, appears more disproportionate than measuring a single moment against a thousand years.

Knowledge, of whatever kind it is, in order to be true and therefore useful, must begin as we ourselves begin, that is at the point of absolute ignorance; and therefore, if we go to the details, and attempt to know the single subjects one by one, our lives would be spent before we had mastered all which is to be met with upon a single acre of ground in a state of nature. All appears in a state of confusion to our untutored observation; and therefore we, in that state, abandon the study as hopeless, and fall back upon our merely animal appetites as our only means of enjoyment.

This we find to be the state of mankind in all countries where the light of science has never come; and yet in the few matters which they do understand, we find that these men of limited information are superior rather than inferior to ourselves. The senses of the savage are always more acute than those of men who are civilised and informed; but there is no principle of progression in them—they do not advance; and we have no reason to suppose that the inhabitants of any scienceless country were one jot better informed at the time when they were first visited by European adventurers than they had been in the hundredth generation previous to that event.

Not only this, but it does not appear that there is any general tendency in them to profit by the example of their more scientific visitors, unless there has been a beginning made before the arrival of them. No doubt there are some rude people, to whom the intercourse of civilised men has given an impulse, and we cannot, perhaps, cite a more striking instance of this, than the case of the New Zealanders; but they were *begun*—had taken some steps—rude no doubt, but still in the way of improvement—before they were visited by Europeans. On the other hand, where there has been no beginning, the savage is consumed before the march of civilisation, instead of being aroused and instructed by it. The Indians of North America have faded to a remnant much faster than can be accounted for by any direct oppression with which they have met—though that has no doubt been severe enough in many instances. When we turn our attention to other parts of the world, be those parts what they may, we find that there is no exception to this; but that the longer these rude tribes have been in the neighbourhood of civilised men, the more have they fallen off in character, and declined in numbers.

There is much information involved in these truths, simple as they are; for they show that the ignorant cannot arrive at knowledge of any kind by the means and the process by which that knowledge has been originally accumulated; and also, that the way of obtaining possession of the knowledge which has been already acquired must be different from that whereby additions are made to the stock.

The record of knowledge is the *index*, as it were, while the original discovery is the labour of the book; and every one must have felt the advantage that there is in consulting a book by the help of a well-arranged index. An index to the words of any one book is most convenient for consultation, when it is arranged in alphabetical order; but an index to the productions of nature requires a different form, because each of

these singly has a story to tell, to which story, until it has been known, no name or other word can be any guide. In this case the best, and indeed the only index that can be of use is, *an index of relations*,—not an index to the individual facts or subjects, but one which shall, from the knowledge of one fact or subject, guide us to a second, from that second to a third, and so on. These relations apply equally to *what exists* and to *what happens*, and they are the means of knowledge, and not knowledge itself—the instrument, not the end. For knowledge, like every thing else, must be of the same kind with its beginning, and be stable or unstable according to the foundation on which it rests. Whether we seek to be informed, relative to the productions of nature simply as they exist, or the phenomena or changes which they display in the course of time, we must have a beginning in addition to our index of relations. Our progress, to use a homely expression, is by means of a bridge, of which facts are the piers, and relations the arches; and though we cannot pass over by means of the piers without the arches, yet the arches can have no support but the piers.

There are two sets of persons, each of which are in possession of one of these elements of knowledge without the other; and for this reason they may be both said to be ignorant. Common observers have the piers of the bridge without the arches; and men who have studied the systems in the books have the materials of the arches, but want the piers for supporting them; and thus, to them, the arches are no arches at all. Their case is much more hopeless than that of the former class; because, just as piers can exist without arches, while arches cannot exist without piers; so facts, accurately observed, are sound knowledge in the exact proportion of their accuracy and to the full extent of their number, whether the possessor of them know the relations between them or not. But still, the piers, notwithstanding all their stability, will not carry one across the river, unless they are brought so near to each other as to become stepping stones, which can be the case only in *the shallows*. Thus, though the matter-of-fact man is not so utterly ignorant as the mere theorist, he is still not in a condition to make advances in knowledge by means of the knowledge he already possesses; and it is the capacity of converting the knowledge which we have into the means, and the certain means, of obtaining more, which is most valuable.

Classification, in the natural history sense of the term, always has reference to beings or existences, and not to phenomena or appearances; though appearances are used as the means of classification; and any classification is valuable in proportion to the kind of appearance, or character as it is called, which is made the basis of it. The doing of this must depend upon the knowledge and judgment of him who makes the classification; and as the classification is the real instrument in the acquiring of knowledge, it is essential that the man who attempts to make or to alter a classification, should possess the most extensive information, and the most sound and scrutinising judgment, upon this very simple and obvious principle, that he who does not intimately know, and justly and impartially estimate all the characters (that is the known characters) of every individual which the class includes, is not prepared for giving a useful or even an honest judgment, as to what should be the common character of the class.

This applies to all classifications, and to all the parts, primary, intermediate, or subordinate, of which they are made up; and in the subordinate parts, those which come as near as possible to the specific distinctions, in which we consider things as identical in their natures, and differing only as individual existences, it is necessary to be more accurate, and to see farther than in the grand and primary divisions. In these cases, no man has a title to alter any classification, unless he is fully prepared to justify his alteration through every step and stage upward to the simplest division which can be made of natural substances, or even up to the simple fact of existence.

And it is especially necessary to impress this truth upon all who are only beginning the study of nature, or who have made but little progress in it. The beginnings of science, though mere molehills in reality, seem mountains in the eyes of the commencing student; and they seem the more so, the more earnestly and even the more honestly that he enters on the study. If we may use the expression, the eye of the mind begins the study of any thing with microscopic power, which magnifies to a very great extent; but as the quantity of knowledge accumulates, the magnifying power diminishes, and after a long life spent in scientific pursuits, individual objects sink down in their importance, and appear insignificant in comparison with the number and magnitude of the whole. Hence it is, that those men who are the best qualified, and therefore the best entitled to make or to alter classifications, always set about making such alterations with the greatest caution and reluctance. And, paradoxical though it may seem, it is nevertheless true, that all the war of systems, and all the wranglings about classifications, which have so often disturbed, and we fear we may add demented, the scientific world, especially naturalists, have really been waged by parties, not altogether dissimilar to those who are said to have fought the first pitched battles recorded by the poets of antiquity, “the frogs and the mice, the pigmies and the cranes.”

With the desire of impressing this truth fully before us, we shall not venture to suggest any particular classification, or any modification of one which exists, but shall confine ourselves to a very simple outline of the meaning of the term, and of the advantages which are derivable from the right use of it.

Nature is so wide a field, that no one science can be made to embrace the whole of it with any thing like precision; and therefore when we speak of natural history in the proper sense of the words, we mean little else than a *catalogue raisonné* of a considerable number of sciences, with some slight sketch of their relations to each other. This may be considered as one primary step of classification, the beginning, as it were; and under it we are not called upon to do much more than to explain clearly what we mean by subject or being, and what by appearance or phenomenon. Some view of this, as it applies to the subjects to be known, will be found in the Introduction to this work; and all that remains would be to mention the names of the different branches of science, as applied to the knowledge of those subjects. This is, however, unnecessary, because it would be impossible, without occupying more space than we can devote to it, to make it the vehicle of much meaning. The three primary subjects are, matter which neither grows nor lives, growing matter, and living matter. The first is a very extensive subject,

and stretches in range beyond all but the very simplest and most elementary observation. It goes to the sun, to the planets, and it speculates to the stars; and in all those regions which form so mighty a volume, that the earth is but a point in its humblest page, all that we can know is distance, magnitude, mass, motion, and mutual influence of one of those bodies upon another. From this vast height, in the extreme of which we are lost in the infinitude of greatness, we descend downward to air, and water, and solid matter, whether in larger or smaller masses, and to every thing, in short, which goes to the composition of our earth, and which is not immediately under the influence of vegetable growth or animal life. Nay, our inquiry into mere matter includes the substance of which all plants and all animals are formed: and we can and do speak about the component parts of them, while they are entire, and growing, and living, just as though these component parts were separate portions of dead matter. Nor do our inquiries stop even here, for it is the province and the business of the student of dead nature, to extend his observation, and apply his reasoning, from the most distant mass to which the line in the balance can be applied, down to the very verge of the primary atom, the smallness of which makes it as inscrutable to our knowledge as it does the magnitude of the other extreme. Within these boundaries there are situated all the sciences which are physical, including chemical science among the number; and in this grand division, the name of natural history is not generally applied to any thing but to the description of those individual masses of matter which can be distinguished from each other by their peculiar characters. But still this humble portion has its use in the system, though taken singly that use is very limited.

Vegetables and animals are less extensive in their scope, because we find them only on the surface of the earth or in the waters; and their situations are generally such as that we can go all round them and examine them, and study their progressive histories in time as well as their momentary appearances. Therefore we have many more characters in the case of them, and thus it is here chiefly that classification becomes of the greatest value, and where the abuse or the captious use of it is calculated to do the most mischief. Accordingly much time has been devoted to the classifying of plants and animals; and the result of this labour, though of course, from the very nature of the case, not altogether or even nearly perfect, has made so much progress as to be highly valuable to the student, by being to him an instrument by the skilful application of which he can acquire more knowledge in a few days than he could without its assistance acquire in a life-time.

The individual classifications applying to both of these departments will be found in the notices, general and particular, of the subjects themselves; and as it would be contrary to the nature and object of a popular work to teach system-making, being the very subject which people should specially avoid attempting, we do not feel that more words are necessary.

CLAUSILIA (Lamarek). This characteristic name was, in the first instance, given to shells in which the entrance of the opening was closed at a certain depth by a moveable ovate testaceous lid, performing the office of an operculum, and supported by a thin elastic pedicle inserted in the columella. This lid closes upon the animal when it retreats within

its dwelling, by means of the pedicle acting as a spring. Lamarek has not been able to ascertain that all the examples he has given of this genus are so provided, but naturally concludes they should be, and has constituted the genus from the other constant and similar characters to be observed in them, the most remarkable of which is that of the termination of the last whorl being quite detached from the base of the shell. The aperture is ovate or rounded, its edge entire, and the margin reflected outwards. These shells are all of them terrestrial, fusiform, slender, and the summit rather obtuse, to which may be added, though not mentioned by Lamarek, that the opening is occasionally dented. The structure of the animal is similar to that of the helix, but having the first pair of tentacula very short. About twelve recent species are known, the greater number of which are European, and found particularly on the borders of the Mediterranean. Several are also known from the American archipelago. Second class, *Paracephalophora*; first order, *Pulmobranchiata*: third family, *Limacinea*.

CLAVAGELLA (Lamarek). This genus of shells was unknown to Lamarek in a recent state. He considered it an intermediate species between the *Aspergillum* and the *Fistulana*, differing from the former by having only one external fixed valve, the other free and internal, and from the latter, which has no perforations at the larger extremity; this shell has also an appearance of small projecting tubes at one extremity round the disk, similar to those of the *Aspergillum*. Sowerby, in his *Genera of Shells*, No. 13, has described the only recent species of this genus supposed to be known. It is classed by Lamarek between the genera *Aspergillum* and *Fistulana*.

CLAVATULA (Lamarek). A mollusc, united to the genus *Pleurotoma* by De Blainville, as being no other than a species of that genus.

CLAVIGER (Preysler). An extraordinary genus of coleopterous insects, nearly allied to the family *Pselaphidæ*, having the elytra shorter than the abdomen, and truncate; the antennæ thick and six-jointed; the eyes are wanting; the maxillary palpi very minute, and apparently without articulations; and the tarsi are three-jointed, the last joint being furnished with a single claw. These curious little insects are not above one-eighth of an inch in length, and are found under stones in dry situations; they are likewise often met with in the nests of ants. M. Muller has published a good monograph upon this genus in the third volume of Germar's *Magazin der Entomologie*, as has also M. Aube, more recently, in M. Guérin's *Magazin de Zoologie*. M. Dalman has described another genus, even more remarkable than the foregoing (to which, however, it is intimately allied), under the name of *Articerus*, and which was discovered by him embedded in the substance so often mistaken for amber, namely, gum animé. The antennæ are composed of a single long cylindrical joint.

CLAVIJA (Ruiz and Pavon). A South American tree, which, when cultivated in a dwarfed state in our hothouses, forms a very healthy ornamental plant. Linnæan class and order, *Pentandria Monogynia*; and natural order, *Myrsinæ*. Generic character: calyx five-toothed; corolla bell-shaped, limb in five lobes; stamens shorter than the corolla, on a cup round the seed-vessel; berry having a free central placenta.

This plant was called *Thcophrasta* by Linnæus and other botanists. It flowers frequently, though the little purple racemes produced from the stem are not very showy. The foliage, however, is handsome.

CLAYTONIA (Willdenow). A genus of tuberous rooted perennials and curious annuals from North America. They belong to the fifth class of Linnæus, and to the natural order *Portulacææ*. The annual and perennial species are sowed or planted in the open air, and thrive best on borders of moor-earth.

CLEAVERS. A very common British plant, the *Galium aparine* of botanists. It receives its name from its seeds, leaves, and slender stalks, being armed with hooked hairs, which cling or cleave to everything. It is, moreover, called goose-grass, from goslings being particularly fond of the leaves soon as they are hatched. It is a troublesome weed to the farmer, it being difficult to separate the seeds from the samples of corn. When these seeds are seen among corn, they are called burrs by the millers.

CLEMATIS (Linnæus.) Herbaceous and shrubby climbers, found in many different parts of the world. Linnæan class and order, *Polyandria Polygynia*; and natural order, *Ranunculacææ*. Generic character: calyx of four to six sepals; nectary, none; stamens fixed below the germen; filaments, dilated at the apex; anthers, two-celled; style persisting, downy; eary-opses tailed. The clematis, or virgin's bower, or traveller's joy, is a well-known European plant. It is this plant which covers our hedges in the autumn with that grey feathery substance, by which it has also gained the name of "old man's beard." It is most abundant, and grows with great vigour, in chalky districts. The presence of chalk at a great depth under the surface is often pointed out by the existence and growth of the clematis. It is an embowering plant, and soon takes possession of the whole head of any plant it can lay hold of; the petioles of the leaves acting like tendrils, by curling round the twigs of the plant which lends support. Almost the whole tribe are attractive one way or other; and some from the easy flowing position of their branches, and elegant tassel-like flowers are much and deservedly admired. The *C. florida*, single and double; the *viticella*, and *campaniflora*, are fine plants, and merit a place in every flower garden. The hot-house species require plenty of space to flower well.

CLEODORA (Lamarck, CLIO PYRAMIDATA; Linnæus). A molluscous animal, but the posterior end of its body is covered by a firm, somewhat cartilaginous, straight, and transparent shell, like an inverted pyramid, or in the form of a spear, truncate and open at the upper part, of a distinct shape in different species, and not opened laterally, or at the posterior end, as in the genus *Hyalæa*. The body of the animal is lengthened, conical, more or less depressed, divided into two parts, as in the *Hyalæa*; two tentacula, two eyes, and two swimming organs at the anterior part; the posterior conical. It differs but little from the *Hyalæa*, next to which it stands in the first order, *Aporobranchiata*; first family, *Thecosomata*.

CLEOME (Willdenow). A genus of undershrubs, perennial and annual herbs, mostly natives of America. Linnæan class, *Tetradynamia*; and natural order, *Capparideææ*. Generic character: calyx of four sepals, the fourth inferior; petals unequal, ascending, three nectariferous glands at the base; stamens many, but only a few fertile; filaments inserted

in the calyx, declining; anthers, ovate and erect; style, simple; stigma, headed; pod, stipitate or sitting, one-celled, and two-valved. These plants flower and ripen seeds readily; they are easy of management, potted in light rich soil, and may be increased by cuttings when they fail to produce seeds.

CLERIDÆ (Nob.; TILLIDÆ, Leach). A family of coleopterous insects belonging to the section *Pentamera*, and sub-section *Serricornes*, distinguished by the dilated tarsi; hatchet-shaped palpi, toothed jaws; the antennæ are more or less serrated, and often thickened at the tips; the eyes are notched internally, and the thorax is generally narrower than the elytra; the body is elongate, sub-cylindric, and of a firm consistence. These insects, in the perfect state, are often found upon flowers; many of the species, however, are only met with under the bark of rotten trees, where they have resided in the larva state. They are of a moderate size, and are generally handsome insects, being much variegated in their colours.

The larvæ, which have hitherto been observed, are carnivorous in their habits. The genera are *Clerus*, Geoffroy (*Trichodes*, Fabr.); *Cylidrus*, *Tillus*, *Priocera*, *Arima*, *Eurypus*, *Thanasimus opilus*, *Clerus*, *Necrobia*, *Corynetes*, and *Enoplium*.

The first-mentioned genus is distinguished by having the labial palpi terminated by a hatchet-shaped joint; the basal joint of the tarsi is nearly as large as the following, and the antennæ are terminated by a three-jointed club, the last joint of which is alone terminally produced into an angle. There are two British species belonging to this handsome genus, namely, the *Attelabus apiarius* of Linnæus, which is blue, the elytra red with blue bands, the extremity being also blue. The larva of this insect is found in the hive of the common bee, where it devours the larvæ of this useful insect, and thus occasions much injury to the hive. It is, however, very rare in this country. The other is the *Trichodes alvearius*, Fabr., very much resembling the preceding; but the region of the scutellum is blue, and the extremity of the elytra red. Its larvæ resides in the nests of the mason bees (*Osmia*) feeding upon the grubs of these insects.

CLERODENDRUM (Linnæus). Shrubs and a few climbers, mostly natives of eastern Asia. Linnæan class and order *Didynamia Angiospermia*, and natural order *Verbenacææ*. Generic character: calyx five-toothed; corolla, tube elongated, graceful, limb spreading, of five equal lobes; stamens protruding, widely parted; anthers ineumbent, bursting transversely; style long, filiform; stigma acute, and cleft; drupe tetrapylene, embraced by the calyx, one-seeded. Some of this genus are splendid flowering plants, and all are more or less ornamental. They are all easy of propagation by young cuttings, or pieces of the roots. Some of the species increase themselves by suckers.

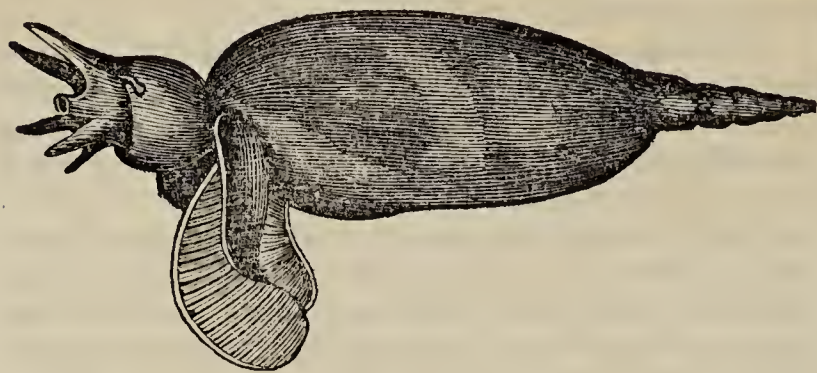
CLETHRA (Linnæus). A genus of handsome hardy shrubs, natives of North America, and a few greenhouse species from Madeira. Linnæan class and order *Decandria Monogynia*, and natural order *Ericææ*. Generic character: calyx five-parted, persisting; petals five, spatulate, concave, longer than the calyx; stamens inserted in the receptacle; filaments like hairs; anthers inversely egg-shaped, opening at the apex; capsule invested with the calyx, three celled, cells full of seeds. The hardy clethras

are usually planted in light loam, mixed with two-thirds moor earth, and are very suitable shrubs for the flower garden, and are increased by seeds or layers. *C. arborea* is too tender to bear the open air of this country, and is usually treated as a greenhouse or conservatory plant. The other species, from the same island (Madeira), require similar treatment, and may all be propagated by cuttings.

CLIDEMIA (D. Don). A genus of tropical shrubs, separated from the genus *Melastoma*, to which they are nearly related, though not so fine flowering plants as some others of that fine natural order. The clidemias are remarkable for hairiness over their leaves and stems.

CLIFFORTIA (Linnæus). A genus of shrubs from the Cape of Good Hope, some of which have been long cultivated in British collections. They are *Diæcious*, and belong to the natural order *Rosaceæ*. They are cultivated more for the variety of foliage they give to the collection than for their flowers, which are not attractive. Young shoots strike root readily under the ordinary management.

CLIO (Lamarck). A naked molluscous animal, of which only three species are named. The characters of this animal are not sufficiently well known to



be described with certainty; it belongs, however, to the family of *Gymnosomata*. The species here figured is the *Clio borealis*.

CLISIOCAMPA (Curtis). A genus of lepidopterous insects, belonging to the family *Bombycidae*, distinguished by its robust thick-set body, short but powerful wings, which are rather acute, and its short curved antennæ; the palpi are of very small size, and the spiral tongue is entirely wanting. These insects are known to collectors by the name of Lackey Moths, a name which they have gained from the gaudy stripes of various colours, with which the caterpillars are ornamented. The perfect insects are of moderate size, seldom exceeding two inches in expanse. "The larvæ of *C. neustria*," observes Mr. Haworth, "are one of the greatest pests our fruit trees labour under. They are sometimes quite defoliated by these voracious caterpillars, and covered over with their noisome webs. The female moth, when she deposits her eggs in autumn, agglutinates them in the neatest manner imaginable, all in close and symmetrical contact, round a twig of about one year's growth. These, hatching a little after the foliage of the tree in spring, do not separate, but live in one society, and form themselves one common web, which they enlarge from time to time, as they find necessary to accommodate their increasing sizes, communicating at length to the almost defoliated tree, a very sickly and disagreeable appearance. The best way of destroying them, and all other tree feeding caterpillars, is to shake the branches violently either with the hand or a pole with a hook to it;

this brings them quickly to the ground, where they are easily destroyed. Poultry, if admitted, will pick them up with avidity."—*Lepidoptera Britannica*, p. 129. This insect is of a reddish-ochre colour, having a darker band across the middle of the anterior wings, margined on each side with a paler colour. It is very abundant, appearing in July and August. In certain seasons, however, from some unknown cause, it is much more rarely to be observed. It likewise attacks other trees. Thus Mr. Jenyns says of it, "The pest of our hedges, which in some seasons are entirely stripped of their leaves by the larvæ, and laid as bare as in the depth of winter." The oak, sweetbriar, sloe and hazel, are also subject to its attacks. The precise manner in which the eggs are so symmetrically deposited by the parent moth, has not been observed, but the form of the eggs themselves are admirably adapted for their spiral position, being in the form of a funnel-shaped wine-glass without a stand, so that when they are placed together in an arched form, they fit as precisely as the arch stones of a bridge, and the cement with which they are covered is so hard, that we have repeatedly slipped them off the branch without breaking the coil. We have also noticed that, although the outside of the eggs is of a dark colour, occasioned by exposure to the atmosphere, smoke, &c., yet the partition between each egg is beautifully iridescent.

It may also be mentioned, that as this cement is neither soluble in water, "nor in any other liquor," says Swammerdam, "which I have tried," they are well defended, in their exposed situations, against the wintry blasts and rains.

The curious motions of these caterpillars have attracted considerable attention amongst the observers of nature. Bonnet, who noticed a nest of caterpillars, evidently of the lackey moths, observes, "I remarked that the sound of my voice appeared to incommode them, for when I spoke they briskly agitated, with repeated jerks, the fore part of the body." He is disposed, nevertheless, to suppose that it was not by any power of hearing, but by the delicacy of their touch, that the sound of the voice was communicated to them. On the other hand, the author of *Insect Miscellanies* has suggested that this jerking motion was for the purpose of producing a rent in the skin near the head "as it was more remarkable just before their moulting than at any other time. This also, as it happens, was the very period when Bonnet made his observations, as he expressly says, 'some of them had undergone, and others were about to undergo, their first moult.'" Mr. Stephens, however, seems to refer their jerking to atmospheric causes. "In *changeable weather*, I have observed," says he "that all the individuals which happen to be resting on the *outside* of the nest, simultaneously and repeatedly elevate the anterior part of their body." For our own parts, we feel inclined to refer these motions to another cause; it will be seen that it is the larvæ on the *outside* of the nest which thus jerk themselves about; we would therefore suggest that it is for the purpose of defending themselves from the attacks of, and driving away any wandering Ichneumon fly, that they thus keep themselves in constant motion.

The other British species, *Bombyx castrensis*, is much more rare than the preceding, which it nearly resembles. It is figured by Mr. Curtis in his *British Entomology*, plate 229.

CLISIPHONTE. A genus of shells constituted by De Montfort, and united by De Blainville with the genus *Lenticulina*. It is only known in a fossil state, and is a microscopic shell.

CLITHON. A genus of shells established by De Montfort, and now united to the genus *Nerita*, of which it forms a subdivision.

CLITORIA (Linnæus). A tropical genus of leguminous climbers, with pretty little papilionaceous flowers, which are produced abundantly if the plants are allowed heat enough. They sometimes ripen seed, from which young plants are raised; or in default of them, they may be renewed by cuttings.

CLIVEA (Lindley). A lately introduced hexandrious plant from the Cape of Good Hope, named in honour of the present Duchess of Northumberland. Generic character: flowers in an umbel; perianth tubular, six-parted, deciduous, parts connivent, the exterior shortest; stamens inserted in the tube, equal with each other, and with the tube; anthers versatile; style filiform; stigma trifid; berry of one seed. This plant has some resemblance to *Cyrtanthus*; but differs from that genus in having versatile anthers, and a one-seeded berry. The bottom of the stem is but very moderately bulbous; grows best in rich loam, and requires a temperate part of the stove to flower in. As it has already ripened seeds in this country it will no doubt soon be in every collection. It was called *Imatophyllum* by Dr. Hooker till it flowered, and was described by Dr. Lindley.

CLIVINA (Latreille). A genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Scaritides*. These insects are of small size, narrow form, with the thorax separated from the elytra by a narrow peduncle; the fore legs are palmated, and formed for burrowing. They are found under stones, at the roots of trees, in damp situations, beneath rejectamenta of floods, &c. There are two British species, one of which, the *Tenebrio fossor*, Linnæus, is about a quarter of an inch long, and of a black pitchy colour. By the French entomologists, the genus *Dyschirius* of Panzer, &c. is united with the preceding; it is, however, distinguished by the globose form of the thorax, and some other characters. There are about a dozen British species; of the latter, some of which are amongst the smallest insects belonging to the *Carabidæ*; they are found on the sea-coast, the banks of streams, &c. Their habits are very voracious, preying upon other insects.

CLOTHO (De Faujus). A fossil shell of an oval form, subregular, longitudinally striped, equivalve; subequilateral hinge, formed by one bifid tooth, hook-shaped, rather larger on one valve than the other; the ligament external.

CLODBERRY is the *Rubus chamæmorus* of Linnæus. This plant is found on the mountains in the north of England and Scotland, and is a low bramble-looking undershrub. It belongs to the natural order *Rosaceæ*.

CLOVE or **CARNATION** is the *Dianthus Caryophyllus* of botanists, and the improved variety of the clove of florists. It ranks as the chief of stage flowers, as it combines elegance of form with variety and delicacy of colours, and to these is added the most delightful fragrance. No plant requires more of the florist's attention than the carnation; to have flowers in the greatest perfection, new plants must be raised every year. Not but that old plants will

continue to yield flowers for several years; but these being those of branches, are never so large or so fine as those on the central stem of a maiden plant. Young plants are obtained by layering the lower branches of the last year's layers; and though these be only the points of the secondary shoots, yet when separated from the parent stock, they become as independent beings, and ten times more vigorous and amplified, than if they remained on their original roots.

The cultivation of choice carnations forms a principal part of the florist's business. They have distinct names; and the superior sorts, especially if they are new, sell at high prices. New varieties are obtained from seed; but very finest age or prize flowers occur but as one in a thousand inferiors. A seedling of promising merit, may, by judicious culture, be advanced to rank with the best; and it is by accident, and such means, that our present stock of fine carnations have been in course of time obtained.

The standard choice sorts are perpetuated by annual layering. This is performed about the time, or soon after the plants are in flower. If cultivated as stage flowers, they are kept in pots, and of a pretty large size, in order that their branches may be conveniently layered. If cultivated in beds, there they are also layered; because there must be an annual supply of young plants, as well for beds as for pots.

Carnations are layered like other plants: the lower branches, which would not flower till the following year, (supposing them to be left on the parent stool) are chosen; an incision is made with a keen pen-knife, entered a little below the third or fourth joint from the top, and passed up the middle of the shoot as far as the next joint. This separated piece is called the tongue, and when the little piece below the bottom joint is cut square off, it is ready to be fixed in the soil. In layering, a little fresh compost is usually laid round the plant to receive the layers. In this, little furrows are made, and in which that part of the layer between the tongue and the root, is bent down and firmly fixed by a little hooked stick. The layer is then covered with about three quarters of an inch of the compost, and at the same time the point of the layer is gently raised upright, taking care that the tongue be kept apart from the place whence it was cut, and pressing the soil pretty closely over and around the point of the layer, to keep it in place.

New roots are soon produced at the lower end of the tongue, and towards the end of September are fit to be taken from the stools, and planted in beds or pots previously prepared for them.

Some florists are very curious in forming their carnation compost; mixing together many different substances, as loam, sand, leaf-mould, and rotten dung of various kinds. Such a compost may be very suitable; but many successful cultivators use only the freshest maiden loam, made sufficiently rich and porous by a third part of thoroughly decomposed stable or old hot-bed dung. In this, carnations, whether in pots or in beds, thrive and flower in the highest perfection, provided they receive all other necessary treatment.

The management of carnations consists, not only in placing the layers in suitable soil, but in taking care that, if potted, the pots be well drained, so that water may not stagnate within, which would materially check the growth, and spoil the beauty of the

flowers. Water must be always supplied moderately, and without excess of either moisture or dryness. The layers, when taken off the stools, are first placed in small sized pots, and usually shifted twice into larger, before they are brought to flower. The most perfect cleanliness, keeping free from weeds, and defending against snails, slugs, earwigs, and woodlice, are all indispensable through the whole course of their growth. When the stems are advancing to flower, they are often attacked by the green-fly or aphides; these must be banished by tobacco smoke, or some other means not hurtful to the plants. Props must also be fixed, to tie the stems to as they advance in height; and as several flower-pods will appear on the same stem, all but the topmost, or the two topmost, should be cut off; this is for the purpose of encouraging the principal flowers to bloom in greater beauty and amplitude.

In order to assist the flowers to expand regularly and handsomely, florists exercise certain manipulations, which are exclusively their own; these are called hooping and cording. The calyx or flower cup is liable to burst irregularly, that is, it will be rent lower down on one side than on the other; to prevent this, two expedients are practised: the first is causing the divisions of the flower-cup to open equally, by assisting the backward ones with the point of a penknife; and the second is by hooping, that is, by fixing a band of matting or soft string round the middle of the flower-pod, by which means the divisions of the calyx are made to burst regularly. These precautions regulate the bursting of the calyx; and in order that the corolla, or coloured petals of the flower, may be expanded laterally and symmetrically, circular cards (having a hole in the centre to embrace the calyx) are fitted on immediately behind the spreading petals of the corolla, the card acting as a support to the petals, which naturally incline to fall back. By these means the petals are exhibited in a plane; their tints and the form of the plant are seen to the best advantage, and when so dressed up by the skill of the professional florist, are certainly objects of great beauty.

These practices are only followed by flower fanciers, who exhibit their flowers at shows for prizes; and at which there is sometimes the most intense and lively competition.

CLOVER. The English name of several species of the *Trifolium* of botanists. The botanical name is given because the leaves are ternate, that is, three leaflets on each footstalk. Some writers have supposed that some one species of this genus is the shamrock, or emblem of the Holy Trinity, the *tria juncto in uno*, used by St. Patrick in explaining that doctrine, when preaching to the first Christian converts in the kingdom of Ireland. Others, and with more reason, have suggested that the true shamrock is the *Oxalis acetosella*, or wood-sorrel, so common everywhere in the groves of Ireland. It is true that there are several species of trefoil indigenous to Ireland as well as Britain, but none of them present the triune character so symmetrically as the leaves of the wood-sorrel; and besides, many of the trefoils being agricultural plants, they may have been originally exotics, and naturalised since the time of the patron saint of Hibernia.

Three of the trefoils are the most valuable acquisitions of the British farmer. Without them he could not make meadows of his arable fields in the short

space of two or three months; without them he could not secure large ricks of winter fodder from off fields which, in the previous summer, had borne a heavy crop of corn, and which will bear even a more valuable burden of wheat in the summer following. These clovers are the red, the white or Dutch, and the yellow flowering or black-seeded trefoil.

The red is the most luxuriant grower, and most useful as a forage plant. It is either sown alone (at the rate of about eight or ten pounds to the acre) or mixed with rye-grass and a little of each of the white and yellow sorts in the following proportions per acre, viz., of red four pounds; of white, Dutch, and yellow, two pounds each; and of rye-grass, three half-pecks. These well mixed together are sown with great regularity by experienced seedsmen, either immediately after barley or oats are sown and rolled down, or upon young wheat in the spring. In the first case one tine of the harrows covers the seeds sufficiently, and when sown upon young wheat the roller only is employed to bury the seed.

When red clover is sown alone, one summer's crops only are taken from it, because being a biennial it yields little or nothing in the third year of its standing. When sown with barley it rises therewith in the first year; much of it is mown with the barley, and makes the straw excellent winter fodder for beasts, and the stubble affords good nibbling for sheep during the cold season. In the second year it is fit to mow for hay in June, and, if not depastured after that time, a second crop may be mown and made into hay about the end of September. But if the second crop be reserved for seed, it is allowed to stand a month longer. Soon as the second crop is cut or grazed off, the clover-ley, as it is called, is immediately ploughed and sown with wheat. Red clover does not prosper if sown too frequently on the same field; the farmer therefore, in whatever course or routine of culture he pursues, always endeavours to have the crops of this clover sown at as distant intervals as possible. The intervals under ordinary management are either four or five years, that is, under the four or five course shift; but by sowing red clover alone in one course, and the white and yellow sorts with rye-grass in the next, lengthens the intervals to eight or ten years. This, as well as all other sorts of herbage intended for hay, should be mown just before they are in full flower.

The white or Dutch clover, otherwise called honeysuckle, is a perennial, and an invaluable plant in all pastures. And when a clover-ley is intended to remain down more than one year, an extra quantity of this species, say five or six pounds, must be sown on each acre. It is a creeping plant, hence the name *Trifolium repens*, but when sown with the others it rises to the height of fifteen or eighteen inches, and makes excellent sheep hay.

The yellow clover or common trefoil is also a valuable agricultural plant, and for all purposes its properties are much like those of the Dutch. It is however of quicker growth, and, if sown on a clean fallow in June, will be fit to be eaten off by sheep before wheat-seed time, a circumstance of the greatest importance to light land farmers. Besides the three sorts of clover above mentioned, there is another pretty extensively sown in laying down permanent pasture. This is the *Trifolium medium*, or cow-grass; it resembles the red clover, but is a perennial, and of a much more diminutive growth. It does not appear

to be relished by sheep, as rank tufts of it may be seen when all the surrounding herbage is closely eaten down.

A new variety of trefoil (not of the cow-grass however) has lately been introduced under the name of *T. incarnatum*, or scarlet trefoil, which bids fair to be a useful agricultural plant; and no doubt many of the species of this family or varieties of them exist, especially on the continent, which are yet unknown to farmers, but which if known might be of great importance in improving our sheep pastures.

CLOVE TREE is the *Caryophyllus aromaticus* of Linnæus, a native tree of the Molucca Islands, cultivated for its flower-buds, a valuable spice known by the name of cloves. The tree is of a middling size, rising to the height of twenty feet or more; and as the flowers are collected by hand-picking, many labourers must be employed to get together the large quantities annually imported into Europe. Specimens of the clove tree are seen in our hothouses, but they are rare, owing to the difficulty of keeping them through the winter. They, however, may be increased by cuttings under proper treatment.

CLUYTIA (Linnæus). A genus of evergreen shrubs from the Cape of Good Hope. Linnæan class and order *Diæcia Monadelphica*, and natural order *Euphorbiaceæ*. Generic character: flowers diœcious; calyx five-parted; petals five; five glands, alternating with bifid or trifid appendices seated below the germen; stamens collected in a column, diverging; anthers fixed by their back, and two-celled; styles thrice divided, and reflexed; fruit three-berried. This genus has white flowers and is rather ornamental; they are free growers and increased by cuttings.

CLYTHRA (Laicharting). A very extensive genus of coleopterous insects, belonging to the section *Tetramera*, and family *Chrysomelidæ*, and distinguished from *Cryptocephalus*, to which it is nearest allied, by its longer and more cylindric body, the shortness of its antennæ, which are serrated along the inner margin from the third or fourth joint to the tip. The head is often very large in the males, with the jaws stronger and more advanced in front, and the fore legs longer than in the opposite sex. There are about seventy species of this genus, described or indicated in Dejean and other works; of these not more than five are inhabitants of this country, including the typical species *Chrysomela quadripunctata*, Linnæus, about five lines long, of a black colour, with the elytra yellowish red, each having two black spots. Its larva resides in a leather-like case, which it drags about with it. That of *Clytra longimana* lives in an oviform case, apparently of a calcareous or earthy substance, joined by a gummy cement, and covered with red hairs, the origin of which Huber, who first discovered them, could not account for.

CLYTUS (Fabricius). A genus of coleopterous insects, belonging to the section *Tetramera*, and family *Cerambycidæ*, and distinguished by its globose thorax, and the shortness of its palpi, which are terminated by a large nearly triangular joint. The body is long and nearly cylindric. The antennæ are not so long as the body, differing in this respect from the majority of the family. The species are of moderate size, and are for the most part elegantly marked with bands of various contrasted colours; amongst them may be mentioned the wasp-beetle, (*Leptura arietis*, Linnæus), a very common British

species, found during the hot summer months in gardens, hedges, woods, upon umbelliferous flowers, and particularly upon the trunks of trees, within which they have passed their preparatory states. This species is generally nearly half an inch long, black, with the thorax and elytra banded with gold colour. There are five or six other British species; some, however, appear to have been imported from America in timber, and found alive in this country.

CNETHOCAMPA (Stephens). A genus of lepidopterous insects, belonging to the family *Bombycidæ*, and nearly allied to *Clisiocampa*, from which it differs in having longer wings, which are "slightly reversed, obscurely diaphanous, antennæ short, slightly curved, bipectinate in the males, serrated in the females; abdomen of the latter sex with a woolly mass at the apex." But it is in the interesting economy of the two remarkable species of which the genus is composed, that the more striking characters are to be found; the first of these is the *Bombyx processionea*, Linnæus, a native of Europe, although not yet ascertained to be British. It is about an inch and half in expanse, with the wings of an ashy brown colour, those of the females having an obscure band, and of the males with three dusky streaks. It is to Reaumur that we are indebted for an account of the curious economy of the larvæ of this species, to which he gave the name of the processionary. They are found congregated in societies of six or eight hundred on the oaks, forming, when first hatched, a temporary nest on the branches; this they abandon from time to time, forming a larger camp until they have attained two thirds of their growth, when they unite their labours and construct one general nest, attached to the trunk of the tree, about eighteen inches long, composed of a greyish silk, resembling the bark on which it is attached, or rather appearing at a distance like a mass of lichens, being in shape like an irregular knob or protuberance, rising from the surface of the tree not less than four inches; between the trunk of the tree and the silken covering of the nest, an orifice is left which serves for the egress of the inhabitants, which takes place in the curious manner, whence the specific name has originated: towards sunset, when the colony go in search of food, with a regularity of the most astonishing nature, a solitary caterpillar first appears at the head of the procession, and by whose movements those of his followers are regulated; three or four then follow in a line, one by one, the head of one touching the tail of the preceding; then follow an equal series of pairs, next of threes, and so on as far as twenty or thirty; the order however is sometimes varied, by the leader being followed by two, then three, and so on. They remain amongst the leaves feeding during the night, generally returning before morning, although some may be occasionally found during the day in masses, heaped one upon another out of the nest. The larvæ shed their skin several times, and in doing so, disengage the numerous short hairs upon the surface of the body; hence Reaumur tells us, that ladies to whom he exhibited the nests upon the oak, were shortly afterwards affected, their necks, which had been bare, being covered with troublesome tumours, occasioned by the hairs lodged upon them by the wind. In like manner Reaumur suffered severely for several days, from having touched the caterpillars with his naked hands, being ignorant of the cause, and having rubbed his

eyes with his hands, he brought on a swelling of the eyelids, so that he could scarcely open them.

It is in this large nest that the caterpillars undergo their pupa state, and indeed become winged insects.

The other species, *Bombyx pityocampa*, feeds upon pines and firs in the larva state, during which it is less perfectly social than the preceding; its processionary habits are nearly similar, but its powers of annoyance are much greater. In this respect this insect was known to the ancients, no less than two enactments of the Roman senate prohibiting its use under severe penalties (see *BUPRESTIDÆ*), being accounted a deleterious poison, the hairs even occasioning a very intense degree of pain, heat, fever, &c. A single specimen of this insect is contained in the British collection at the British Museum.

COAL. The origin of this bituminous substance will be traced under the general article, *GEOLOGY*; and we purpose confining ourselves, in the present place, to a concise view of the four principal species. These are brown coal, black coal, cannel coal, and glance coal.

Brown coal is imperfectly bituminous; in all its varieties it is fibrous, and in some of them its vegetable origin is so complete, that the remains of trunks and branches of trees are almost perfect. Brown coal burns with a weak flame and disagreeable odour. It is found in alluvial strata, and in some others of comparatively recent origin: it is subdivided into four varieties, viz. bituminised wood, earthy brown coal, compact brown coal, and moor coal.

Black, or slate coal, which is the foliated coal of some mineralogists, is very bituminous, and is used for economical purposes; it includes several varieties. It may, however, generally be said to be of a black colour, having an iridescent tarnish, and a highly resinous lustre.

Cannel coal is chiefly found at Wigan, in Lancashire, but it is more or less abundant in most collieries. It is very brittle, of a shining lustre, and burns quickly, leaving only three or four parts in the one hundred of ashes.

Glance coal is of a dark iron black, and has a bright metallic lustre. It burns without smoke, and emits no sulphureous or bituminous odour. It generally consists of comparatively pure carbon, with some silica or alumina, and a small portion of oxide of iron. There are three varieties of glance coal; the conchoidal, the columnar, and the slaty; the last of which is again subdivided into three varieties, anthracite, Kilkenny coal, and Welsh culm.

Jet or pitch coal is generally of a velvet black; it occurs massive, and sometimes in the shape of branches, with a regular woody structure. It has a brilliant resinous lustre. It is used as fuel, but the finer and harder pieces are worked into trinkets, under the name of jet.

What is called a "coal field," or district, or sometimes a "coal basin," may be regarded as a concavity; varying greatly in extent from a few to many miles, and containing numerous strata or seams of coal of various degrees of thickness, alternating with sandstone and clays, and soft slate or shale, containing impressions of vegetables, and sometimes the remains of fresh water shell-fish. The parallelism of these strata is generally well preserved. The whole arrangement is seldom any where quite horizontal, and never vertical, but always more or less inclined. Beneath each stratum of coal, there is often one of soft

clay, which rarely contains the organic remains of the overlying shale; and although the alternating strata of coal be very numerous, it is seldom that more than three or four will afford profitable occupation to the miner. The upper seam is commonly broken and impure; and few beds, less than two or three feet in thickness, are followed down to any great depth. The depth of the mines will of course vary considerably, according to the inclination of the strata, the time they have been worked, and other circumstances. Our deepest mines are in the counties of Durham and Northumberland, and the thickest beds are found in Staffordshire.

COATI (*nasua*). A genus of carnivorous mammalia, belonging to the division *Plantigrada*, or those which walk on the entire soles of the feet. They are found only in America, and there are but two species, the chief distinction of which is one of colour.

Their characters are: six incisive teeth in each jaw, two canines and six grinders on each side. The canines are of very peculiar form. They are not conical in their section, as is the case with those of other carnivorous animals, but flattened externally and internally, with a slight ridge on the inner surface, and trenchant anteriorly and posteriorly, so as to bear some resemblance to the teeth of the sharks, only they are not serrated in their trenchant edges, as the teeth of sharks are, and they have true roots inserted in *alveoli*, in the same manner as the teeth of other mammalia. They have three false grinders, the first one conical in both jaws, the two following ones tuberculous, and resembling those of the bears; the most striking external character, however, is that of the snout, on account of which they have obtained the generic name of *nasua* "nosey." This member is very much produced, extending fully an inch in advance of the incisors in the upper jaw, and being furnished with powerful muscles, resembling those that give motion to the snout of a pig. There is considerable difference, however, between the use of the elongated snout in the pig and the coati; and there is a corresponding difference in the organisation. Both snouts are adapted for digging, or routing up the ground, and perhaps, for the size of the animal, the snout of the coati is, in this respect, the more efficient instrument of the two. But the snout of the pig is the organ which guides that animal to its subterranean food, and accordingly the extremity of it is remarkably well furnished with nerves, being in fact the most sensitive part of the animal, and possessing a delicate sense of what is called touch, as well as of smell, which last does not appear to be very acute in the pig family. The snout of the coati, on the other hand, is destitute of nerves, at least in the portion which projects beyond the upper intermaxillary bone; and thus the animal has perhaps less feeling in this particular organ than in any other soft part of its body. In its substance it resembles not a little the cartilaginous pads which are found on the feet of many animals, and which, being little sentient themselves, are adapted and intended to protect the more sentient parts from external injuries. These pads are immoveable, being mere appendages to the skin, and not provided with any peculiar muscles; but the snout of the coati is not only very moveable, but the animal keeps it continually in motion, even when it is not used for its proper purpose of digging; so that one would be led to think that it does so, merely to prevent the snout from

stiffening for want of use. This is indeed simply a digging nose, and does not appear to perform any other function, at least in the lengthened part of it; and therefore it is not only a peculiarity in the animal kingdom, but it is perhaps one of the best foundations of generic distinction in the whole of zoology.

Animals of this genus have five toes on all their feet, the three intermediate ones being the longest, and the thumb or inner one the shortest of the whole. These feet are furnished with sharp and crooked claws, which are not at all adapted for digging; and indeed, though the animal dwells in burrows, it appears to excavate those burrows entirely by the action of the nose, and it is probably the only one of the mammalia which does so. The soles of the feet are furnished with tubercles, one very large one, answering to the three middle toes, very soft in its substance, but rendered adhesive by having the surface divided into smaller tubercles. The pupil of the eye contracts in the daylight to a transverse line. The ears are short and rounded; the tongue is soft and extensible like that of the bears, to which indeed these animals have a very considerable resemblance in their general character of being among the most omnivorous of the sub-order. The body is very long, as compared with the legs, which are not only short in their absolute length, but appear still shorter when the animal walks, in consequence of the whole sole being applied to the ground. The tail is of the same length as the body, of nearly equal thickness throughout, and when the animal walks it is carried recurved over the right in the same manner as in many of the monkeys. The hair over the whole body is thickly set, and of uniform length. The head is much elongated, and bears no inconsiderable resemblance to that of a fox, only the continual motion of the cartilaginous snout gives a very singular expression to the animal.

These animals are chiefly found in the forests of South America, where they assemble in small packs, and make their burrows or nestling places under the roots of old trees. This habit is a necessary consequence of the peculiar form of their digging instrument; for as the snout necessarily digs by an upward motion, it is obvious that it cannot dig so as to leave a firm roof, as is the case with those animals which dig downward or laterally with the paws; indeed, it is quite evident that an upward digging animal could not possibly get under a roof of earth at all, unless it were to burrow in the face of a perpendicular bank, and these animals are found in the dry forests, rather than by the margins of the waters. It is said that they often undermine the trees to such an extent, that when even a moderate wind comes, they are overturned in great numbers; and thus the coatis serve, to a very considerable extent, as foresters or woodmen, in cutting down, or which comes to the same thing, uprooting those trees which have begun to enumber the soil. They are by no means inexpert, as they climb, and pursue birds, and also rob nests in the trees. Contrary to the general habit of climbing mammalia, they descend the trunks of trees headforemost, and they do this in consequence of a peculiar mode which they have in reversing the hind feet externally, and thus suspending their weight by their crooked claws. It is said that in a state of nature, there are many more males produced than females, and that the bachelor coatis live solitary in the woods.

As their motion on the ground is very slow, and as they are incapable of digging so as to bury themselves, they are easily taken, and they do not refuse to live in a state of confinement, in which indeed they are very tame, and fond of being caressed, though they do not follow their masters, or show much attachment in return. While feeding, they are suspicious animals. They use their fore-paws as hands in feeding, and also in dividing their food, so as to fit it for being received into the mouth. They are very restless and inquisitive in their manners, continually moving about.

As already mentioned, there are only two species, both natives of South America; and it is doubtful whether even these are any thing else but varieties differently coloured, but the differences of colour is very considerable. These two species are the red and the brown.

The red Coati has all the parts of the body of a bright red, with the exception of the muzzle, the ears, the soles of the fore feet, and some spots or bands on the tail, but the ridge of the back is darker than the rest, and has a blackish tinge. The muzzle is greyish black on the upper part, and grey on the sides; and there is a white spot surrounding each eye. The covering is everywhere of very thick and rough hair, which consists of two sorts. The colours appear to be subject to considerable variations. The smell of the animal is strong and offensive.

The brown Coati is still more variable in colour than the red; but its most constant character is described as being two white lines, which extend along the sides on the back of the muzzle, and meet the circles which surround the eyes. The most decided character, however, is described as being the different number of mammæ in the females, the red having five pairs, and the brown only three; but it does not appear from all the information which we possess, that the number of young in the red is equal to that of the mammæ, as is the case with most of the animals of South America. We are, however, in a great measure ignorant of the manners of the coatis.

COBÆA (Cavanille). A Mexican ornamental climbing perennial, common in greenhouse collections. Linnæan class and order *Pentandria Monogynia*, and natural order *Cobæaceæ*. Generic character: calyx bell-shaped, five-cleft, peltate at the base and persisting; corolla bell-shaped, five-lobed, lobes three-cleft; stamens declining, filaments twisted; stigma three or five-cleft; capsule inversely egg-shaped, from three to five-celled, all the valves opening, seed imbricated and margined. This plant having large purple flowers, fine foliage, and a free grower, is a great favourite, especially for hiding the columns in a conservatory, or covering the back wall of a greenhouse. In the summer months it grows well in the open air, and quickly forms a bower over any kind of trellis or veranda, which it may be desirable to cover with verdure and showy flowers. As it ripens seeds, new plants are easily raised, or it may be increased by cuttings in moist heat. The *C. scandens* was formerly included in *Bignoniaceæ*, but now forms an order by itself.

COBALT. This metal is rarely found pure in a native state. The cobalt from Tunaberg in Sweden is combined with sulphur; in other cases it is mineralised by arsenic; and both of them much resemble iron pyrites in form and colour. At one place in

Hungary, cobalt occurs combined with sulphuric acid, forming stalactites of a pale rose colour. The hexahedral cobalt pyrites occurs principally in Norway and Sweden. This may be considered as one of the most common species of cobalt, and is that from which the cobalt of commerce is principally obtained. It is peculiarly distinguished by its silver-white colour, great hardness, and weight. Octahedral cobalt pyrites occurs in Cornwall, and in several parts of the continent of Europe.

This mineral derives its name from one of the superstitions peculiar to the German miners, where it was first found. The great mines in that country are still supposed to be haunted by evil spirits, named "Kobolden;" and those minerals which had the appearance of rich ores, but which in reality afforded nothing valuable, were considered as the production of these spirits, and were hence named Kobold. A large proportion of the cobaltic ores, now so well known to the scientific mineralogist, were thus, through the ignorance of the miners, thrown away as useless, under the name of kobold or cobalt.

COBITIS (Loche). A genus of soft-finned fishes, with abdominal fins, belonging to the carp family, the characters of which are: the head small, the body elongated, the skin covered with small scales, and having a copious mucous secretion; the ventral fins placed far backwards, and over them one small dorsal; the mouth, at the end of the muzzle, small in the opening, and toothless, but furnished with fibres, and having the lips so formed as to serve for a sucker; the gill-openings very small, and furnished with three rays only. The lower bone of the pharynx strongly toothed; they have no cæca, and their air bladder is very small, adhering to the third and fourth vertebrae of the spine. There are several species, three or four of which are natives of the fresh waters of the more temperate parts of Europe. They are very small fishes, and of minor importance, though the flesh of some of them is considered a delicacy. Only two of this genus are mentioned by ordinary writers on British fishes.

The Loche (C. barbatula), is found in some of the clear running streams of the southern parts of Britain. It is a small fish, only about four or five inches long, and of a yellowish colour, clouded and spotted with blackish-brown, and the under part white. The mouth is very small, with a beard or filament at each corner, and four in front of the snout. It spawns early in the season, about the month of April. Its flesh, though small in quantity, is of a good flavour. This species lives only in running streams; but still Frederick I. of Sweden, contrived to have it transported to that kingdom, to serve as a *bonne bouche* at his royal table.

The Groundling (C. tænia) is rather smaller than the common loche, and is distinguished from it by a forked spine under each eye, which is moveable. The ground colour of this species is orange, and the spots black. It is not known in so many parts of England as the other, probably because it is in no estimation for the table. It inhabits running waters, and is found lurking among stones.

The pond Loche (C. fossilis). This is a much larger species, attaining sometimes the length of about a foot. This species inhabits still waters, such as ponds and ditches, in the sludge and mud at the bottom of which it buries itself to a considerable depth, and will continue to live there for a long time, when the

water is frozen, or when it is dried up. This species has two cirrhi or barbules at the mouth. It is long and slender, and beautifully striped across with brown and yellow. Its flesh is not only in small quantity, but of indifferent quality, soft and of a disagreeable smell; but the fish is, notwithstanding, often kept in glasses as a matter of curiosity.

The beauty of its colours, and the liveliness of its motions, form part of its attractions; but not the only, or, indeed, the principal ones. It is exceedingly sensitive to changes of the atmosphere, and therefore it serves as a sort of barometer, or rather "weather wiser." We might refer this property of it, from the habit which it has of burying itself in the mud, as the same habit is attended by similar sensitiveness in leeches and several other creatures. It seems indeed to be a pretty general law of nature, that animals which live in the mud at the bottom of waters are much more delicate to atmospheric impressions than those which inhabit nearer at top. Of this we have a remarkable instance in the common eels, which, even in the warmest parts of England, descend the rivers, and bury themselves in the mud and sludge of the estuaries, during the winter months, while many of those fishes which inhabit much nearer the surface, actually ascend the rivers at the same season. There is no doubt something physiological in this habit of eels, and that they seek the high temperature of the top of the brackish water, in order to bring forward their spawn; but still, as this act is purely instinctive, and not the result of any speculation or design in the eels themselves, it must be dependent on natural causes, and the only cause to which we can assign it, is the influence of atmospheric change upon their bodies.

The pond loche appears to be more susceptible than even the eel. When the weather is boisterous they come to the surface, and seem to partake of the turmoil of the atmosphere, by driving about with great rapidity; and from the lightness of their make, and the liveliness of their motions, their appearance is very interesting. On the other hand when the weather is cold and sullen, they sink down to the bottom of the glass, and remain in a state of complete repose. It has been said, and alleged and proved by positive experiment, that these fishes are in the constant habit of swallowing air, which they discharge from the vent, converted into carbonic acid gas. This allegation is so contrary to the general habits of fishes, who do not even breathe free air, and so different from the habits of all animals in the fact of discharging carbonic acid from the bowels, that it would require to be established by very nice and very frequently repeated experiments.

Three-bearded Loche (C. tricirrhata). This species has been found in the running brooks about Rouen, about the time of the vernal equinox, with the milt and roe in a state of great forwardness. It is reddish-brown on the upper part, with small spots of a darker colour; and the under part, together with all the fins except the dorsal and the caudal, are clear straw-colour; these two fins are blackish.

Several species of loche are mentioned as inhabiting the brooks and tanks of India; and there is little doubt that there are many species yet to be discovered in various parts of the world. It appears, from the remains of fish imbedded in the earth in a fossil state, that this genus was very abundant in former times; for even the species with which we are at

present acquainted, as living inhabitants of the fresh waters, are found imbedded in the earth, though only, we believe, in fresh water formations. Indeed from the habit which these fishes have of burying themselves in the mud, we might easily conclude that small and feeble as they are, they are much more likely to be preserved in the soil, than more powerful fishes, which have no such habit; for we have only to suppose that the return of the water to their temporarily dry haunts is accompanied, as it often must be, with a mass of stones and gravel of considerable thickness, in order to see how they must frequently be buried in the earth to such a depth, as to be equally beyond the power of escape, and the chance of decomposition. By attending to the habits of those animals, which are found both in a living and a fossil state, we are often enabled to make the past and the present history of the animal kingdom throw light upon each other.

COBURGHIA (Sweet). A hexandrious bulbous plant introduced from South America, which was first called *Pancratium incarnatum* by Kunth, but described and figured in Sweet's Flower Garden, and re-named by the author in honour of Prince Coburg, now king of Belgium.

COCCIDÆ (Leach; *Gallinsecta*, Latreille; genus *Coccus*, Linnæus). A family placed by Latreille in the order *Hemiptera*, and sub-order *Homoptera*, but considered by De Geer and some of the most recent French entomologists as forming the type of a distinct and very anomalous order. The species of this family, which are generally called scale insects, are of small size, having, in the winged individuals, short legs, with only two joints to the tarsi, and a single hook at the extremity of each. The male is destitute of a mouth, but is furnished with two large wings and a pair of small appendages behind the wings, resembling the poisers of the diptera; the abdomen also in this sex is terminated by two or more slender filaments. The antennæ are moderately long and filiform, the number of joints not exceeding eleven. The females on the contrary, in their perfect state, are amongst the least perfectly organised of insects, appearing only as an inert scale-like mass, destitute of legs or antennæ, and affixed to the bark of various trees and plants, which consequently appears, from the number of individuals collected together, to be covered by a vast number of galls of an oval or rounded form; these are, however, female cocci affixed to the plant. In their early stages, however, these insects are smaller and more active, having much the appearance of tiny red tortoises, and feeding like their parents upon the stems or leaves, which they pierce by means of a long and sharp rostrum, which goes to the very centre of the shoot, causing the sap to flow in abundance, or bleeding the plants as it is termed, and by which means great injury is done, especially to the vines, which are liable to be much infested with them, and which are thereby sometimes rendered barren. In this state they continue growing in size for some time, but the period soon arrives when the sexes undergo a very singular difference in their transformations. All the insects now affix themselves to the surface of the plants or stems, the little activity which they had previously possessed entirely ceasing. The males discontinue to increase in size, and if one of them be opened carefully, a small and elegant chrysalis will be found within the old skin of the larva; the females, how-

ever, continue to increase in size until they are many times larger than the other sex, the margins of the body being glued down to the plant, the body being by degrees distended by a very great number of eggs until nothing more than the upper and under skins of the insect remains. Soon afterwards the male fly, of a very elegant form makes his appearance, and being unprovided with any means of taking food is adapted only for continuing the species. After impregnation the female commences the deposition of her bag of eggs, but the mode in which this is performed is quite unlike what takes place in other insects; immediately beneath her body is a layer of white gummy matter, in the midst of which the eggs are deposited, and which prevents them from sticking to the rind of the bark, so that they are pushed by degrees beneath the body, which at last becomes nothing more than a thin covering composed of the upper and under pellicles, *under* which are now to be found the eggs which had before been *between* them. The female then dies, and the young ones when hatched make their way from beneath this scaly covering, again to perform a like succession of ravages. These insects are often so injurious that various plans have been resorted to for destroying them, such as scraping the bark, washing it with soap and water, or a decoction of bitter aloes, &c.

Some of the species of this family are highly prized for the fine red dye which they afford, amongst these the most valuable is the cochineal insect (*Coccus cacti* of Linnæus), an inhabitant of Mexico, where it is cultivated upon a species of opuntia. In our botanical article **CACTÆ** is given an account of its habits, &c. In the last part of the Annals of the Entomological Society of Paris, we find it stated, that the French colonists of Algiers have undertaken the cultivation of the cochineal with great success. There have been three generations of the insect in the course of a year and a half, and in a very short period 1000 square feet of cactus will be inhabited by this precious insect, so that it may be fairly said to be acclimated in that *colony* as we find Algiers now termed. Another species, *Coccus adonidum*, is very abundant in our hot-houses, where it does much injury to the vines; it deposits its eggs in an envelope of white cottony matter. Dr. Kidd has published an interesting account of it in the Entomological Magazine, vol. ii. We have already, in our article **CHERMES**, given a notice of the distribution of this genus, and shall therefore only here mention, in addition, that various other genera have recently been proposed by M. Genc, in the Fauna del Regno di Napoli; and that in the curious allied British genus *Dorthisia*, the female does not lose the power of locomotion, the male having the abdomen terminated with numerous long and very delicate white hairs.

COCCINELLIDÆ (Latreille). A family of coleopterous insects belonging to the section *Trimera*, and including the insects familiarly called lady-birds, lady-cows, &c. The body is nearly hemispherical, the thorax short, transverse, somewhat lunate, the antennæ are very short, and terminated by a compressed inarticulate club, the terminal joint of the palpi is large and hatchet-shaped, and the tarsi are composed of only three joints, of which the second is deeply cleft. This family corresponds with the Linnæan genus *Coccinella*, and comprises an extensive series of small but pretty insects, having the body

ornamented with spots and marks of various colours, amongst which black, yellow, and red are most conspicuous. They appear early in the spring, and are amongst the earliest of our youthful recollections; they creep but slowly, although they fly well, and are found upon various plants, especially those infested with aphides; hence the injury done by the latter insects has by ignorant persons been attributed to the coccinella, whereas so far is this from being the case, that the last-mentioned insects feed, on the contrary, upon the aphides both in the larva and perfect state, and never touch the vegetables infested. The eggs are laid in patches on various kinds of leaves in the midst of the aphides, and are of a bright yellow colour. The larvæ when hatched are accordingly in the midst of their food. They are very active, provided with six legs. The body is depressed and elongated, gradually narrowed behind to a point, and furnished at the extremity with a fleshy tubercle which is employed as a seventh leg, and by which on assuming the pupa state they attach themselves, with the aid of a glutinous secretion, to the under side of leaves, where their skin by degrees wrinkles up, the body of the pupa being much shorter than that of the larva. The imago is produced in about twelve or fifteen days. There are several broods in the course of a year; the service which these insects render to the agriculturist must be very great when the vast myriads of coccinellæ, which are occasionally noticed, are taken into consideration. In the "Introduction to Entomology," we find various statements relative to their appearing, in certain seasons, in immense profusion, especially upon the sea coast, to the no small alarm of the superstitious, by whom they were regarded as forerunners of some direful evil, and who were, of course, ignorant that these little visitors were emigrants from some neighbouring hop-ground, where each had slain his thousands and tens of thousands of the aphides, which, under the name of the fly, so often blasts the hopes of the hop-grower. In France they are regarded as sacred to the Virgin, and are accordingly called *Bêtes de la Vierge*; *Vaches à Dieu*, &c. Even the hop-growers are beginning to be sensible of their services, and hire boys to prevent birds from destroying them. It may also be mentioned that it is an easy thing to clear a favourite plant from the destructive aphides by placing upon it several larvæ of the lady-cows, or of some of the aphidivorous flies, which may constantly be found in the midst of the plant-lice upon other neighbouring plants. When these insects are touched they immediately fold up their legs, and emit from the joints a yellow mucilaginous fluid of a very disagreeable odour, and which in the common seven-spotted lady-bird, *C. septem-punctata*, has been considered as a remedy for the toothach. The variations in colour exhibited by some of the individuals of the same species is very striking, and has caused great confusion in the systematic description of these insects, varieties having been regarded as species, and *vice versa*; moreover, individuals of different colours are found coupled together, but the result of this kind of union has not been observed.

The genera belonging to this family are *Chilocorus*, *Coccinella*, *Sphærosoma*, *Scymnus*, *Rhyzobius*, and *Cacicula*, all of which are British. Latreille likewise adds, in the Règne Animal, two other genera, *Lithophilus*, which is nearly allied to *Triplax*, and *Clypeaster*, which is more naturally placed by Mr. Stephens with *Phalacrus*, &c.

The genus coccinella is distinguished by having the elytra smooth, without rows of punctures, and destitute of pubescence, and the thorax is angulated behind. There are about thirty species of this genus, varying in length from one-third to one-eighth of an inch, nearly all of which are subject to a very great variation in colouring. The type of the genus, and one of the largest and commonest species, is the *C. septem-punctata* of Linnæus, mentioned above, and is of a red colour, the elytra having seven circular black spots.

COCCOLOBA (Linnæus). A genus of fruit, timber, and ornamental West-India trees, belonging to the eighth class and third order of the sexual system, and to the natural order *Polygoneæ*. Generic character: calyx five-parted, persisting, and at last becoming thick; corolla none; filaments awl-shaped; anthers twined; style spreading, nut one seeded; berry included in the persisting calyx. Most of these plants have very large leaves; one of them, *C. sativa*, is called the sea-side grape, because it yields eatable fruit. Some of them grow well in our stoves and are increased by cuttings.

COCCULUS (Boschin). A genus of East-Indian climbers belonging to *Hexandria Trigynia*, and to the natural order *Menispermaceæ*. Generic character: calyx of from three to six bractea-like sepals; corolla of three or six petals; nectarium of six scales; stamens opposite the petals; filaments awl-shaped; anthers two-celled. Fruit drupaceous one-seeded berries. The *C. indicus* is a well-known drug, and forms a considerable article of commerce, and for one purpose or other is used in great quantities in this country. Its hot acrid quality is useful in medicine; and it is said that it is also used by the compounders of stimulating liquors. Several of the species are kept in our hothouses, and propagated by cuttings.

COCHINEAL FIG is the *Opuntia cochinillifera* of Haworth. It is an icosandrious plant, and belongs to the natural order *Opuntiaceæ*. This opuntia is a native of South America, and the plant on which the coccus insect is found, and when collected and dried, forms the famous cochineal dye. For this purpose it is extensively cultivated in its native country, and has been carried to other parts with a view to the introduction of the insect also, but with only partial success. The plant is easily transported, as we have already had occasion to state. It grows well in our greenhouses, and no plant is easier propagated, as every joint of the stem will strike root if kept in dry earth.

COCHLEARIA (Tournefort) is the scurvy grass of English herbalists. It belongs to *Tetradynamia*, and to the natural order *Cruciferae*. The *C. armoracia*, or horse-radish, is a well-known and extensively cultivated condiment in cookery, and is perhaps as profitable a crop as can be grown by the market gardener. A piece of ground judiciously planted with horse-radish yields in the third and fourth year afterwards a vast number of marketable roots.

As the under-ground stem is the only useful part of the plant, the object of the cultivator is to have this as large and long as possible. The most common and successful method is trench planting, and which is performed in the following manner: the ground to be planted is divided into parallels, marked by the line and spade, two feet wide each. The earth of the first trench is dug out and thrown or barrowed to the opposite side to fill up the last. The sides of the trench should be worked upright, and to

the depth of full sixteen inches. The bottom should be broken up either with spade, fork, or mattock. On this, when duly levelled, two rows of sets are to be placed six inches from each side of the trench, which will leave a twelve-inch space between the rows. The sets may be put six or eight inches apart in the rows, and when the first trench is thus planted, it is filled with the earth from the second, breaking it well as it is thrown on the sets. The second trench being thus opened, the bottom stirred, and planted similar to the first, is filled with the earth from the third, and so on to the end.

The sets are inch-pieces of old roots. Some writers advise the crowns only to be chosen; these are certainly to be preferred, but any sound part of the root, whether great or small, will do for sets. From each set a single shoot is produced, and which after two or three years' growth is fit for use. As the shoots rise in rows one foot apart, they should be carefully taken up one after another, beginning at the first. In doing this it is usual to replant the vacant ground as the digging up proceeds, so that the plantation may be kept constantly furnished and productive; for as the spot chosen for the growth of horse-radish in private gardens is always some bye corner of the garden or orchard, it is seldom necessary to change its place.

Horse-radish may also be planted by a dibber of sufficient size and length, after the ground is trenched. The holes are made by line, and the sets dropped in, pressed to the bottom, and covered with fine sifted earth. Another mode of culture is by planting crowns or sets in shallow trenches, and earthing up the plants by covering them over eight inches deep in the winters of the second and third years; by this plan very large stems are obtained. There is yet another simpler method sometimes practised. The sets are dibbed on the surface of prepared ground; these produce a strong descending root, which in the second or third year is large enough for use.

Horse-radish seldom produces perfect seeds, because the principal energy of the plant is directed to enlarge the root, it being a law of vegetation that when seeds are produced plentifully the root is diminutive, and *vice versa*. Planting may be done any time during winter or spring; and as the leaves do not appear till near midsummer from deep planted sets of new plantations, it is usual to take a spring crop of radish, lettuce, or spinach, off the ground before the horse-radish comes up.

COCHLEOCTONUS (Meilzinsky). A genus of coleopterous insects, belonging to the section *Pentamera*, nearly allied to the glow-worm family *Lampyridæ*, and established for the reception of the large wingless and unwieldy females of the long previously established genus *Drilus*, which see.

COCHLOSPERMUM (Kunth). A genus of lofty trees found in Mexico and India. Linnæan class and order *Monadelphia Polyandria*, and natural order *Ternstræmiaceæ*. Generic character: calyx first in five parts, afterwards very much divided; stamens inserted in the receptacle; seed-vessel a utriculus, containing one seed. These trees were considered by Linnæus and Willdenow to belong to the genus *Bombax*, from the East Indian one producing a substance like cotton, hence it received the specific name of *Gossipium*.

COCKCHAFFER. A common insect, being the *Scarabæus melolontha* of Linnæus, or the *Me-*

lontha vulgaris of modern authors. See *MELOLONTHIDÆ*.

COCKROACH. A well-known domestic, disgusting insect, systematically distinguished under the name of *Blatta orientalis*. Full details of its habits will be found under the article *BLATTIDÆ*.

COCKS'-FOOT GRASS of agriculturists is the *Dactylis glomeratus* of Linnæus. It is a strong-growing British grass, and is always chosen as one of those to be sown in forming permanent pastures. It is next to the rye-grass for earliness, and having strong roots, produces a thick tuft of succulent leaves, very suitable for early lambs.

COCKSPUR THORN is the *Cratægus crusgalli* of Linnæus. It is a North American plant, and has long been cultivated in this country as a shrubby ornament. There are four or five varieties in nurseries, and, like all the genus, admired for their snowy blossoms in May. They are mostly propagated in this country by grafting on the common whitethorn.

COCOON. The envelope of silken or other materials, formed by the larvæ of many insects, immediately previous to their assuming the pupa or chrysalis state. Perhaps in no department of our knowledge of the lower tribes of animals, is there so much skill, or so much of that faculty which we term instinct displayed, as in the proceedings which characterise the formation of these envelopes. All larvæ, however, do not make these coverings, the cause of which is at once obvious; the pupa of the grasshopper or cockroach, dragon-fly or cimex, is an active animal, continuing to enjoy all the habits of the larvæ, and consequently not needing any other defence than it possessed in its former state, but in other insects the case is entirely different; the pupa state being one of inactivity and total helplessness, and in which the insect is consequently subject to the attacks of any stray bird or mouse, or not less voracious insect, which would feast with as much avidity upon the soft and creamy substance of the newly formed chrysalis, as the Romans did upon the cossus, which was a large insect in the earlier stage, and which is considered to have been the larva of the goat moth (*Cossus ligniperda*). Hence the necessity, not only for retreat to some quiet and unobserved corner or hole, but also for a covering for more complete concealment and defence. At this time many larvæ accordingly make their way several inches deep into the earth. Here, or concealed under leaves, moss, or other like matter, many insects become pupæ, with the mere precaution of fastening the substances which conceal them together with a glutinous secretion from the mouth; but others are far more careful, forming for themselves an entire covering, composed either of silk spun from their own mouths, or of silk united with the adjacent materials. Some few larvæ, however, as those of the ant-lion (*Myrmelcon*), and the lace-winged aphidivorous flies (*Hemerobius*), have the spinning apparatus placed at the extremity of the body.

Some cocoons are formed simply of a few threads, spun into an open work case, which permits the inclosed insect to be plainly perceived through the meshes; this is the case with the gipsy and satin moths (*Hypogymna dispar* and *Leucoma salicis*), &c. Such is also the case with the cocoons of some of the weevils and chrysomelidous beetles. The cream spotted tiger-moth (*Arctia villica*, see vol. i. p. 550), is more careful, forming a much closer cocoon, but

which, nevertheless, permits the inclosed chrysalis to be seen through the small meshes. This cocoon is moreover defended, by being formed in the middle of a bunch of leaves; and here it is interesting to notice, that those caterpillars which are furnished with a short supply of silk, are nevertheless very anxious to conceal their slight cocoon in the most effectual manner, by attaching together with silken cords the adjacent leaves; sometimes two or three being drawn together, so as to meet at the edges, and sometimes a single leaf being pulled out of its natural position, so as to form a complete covering to the cocoon. Sometimes, moreover, several caterpillars unite together, so as by their combined strength to secure several leaves more firmly together, within which they then, in company, undergo their transformations. Even many caterpillars, which spin a very compact cocoon, resort to the same kind of manœuvre, rather, we should presume, as a means of support than of defence. Other curious means are adopted by some larvæ, for the purpose of rendering their slightly formed cocoons more opaque; thus by some a kind of paste-like matter is secreted from the anus, which, being applied by the head upon the entire inner surface of the cocoon, hardens and forms a powder, which completely answers the intended purpose; it is probably a similar secretion which gives to the chrysalides of the *Catocalæ* the fine purple bloom, which we have mentioned in our account of that genus. Others, again, as the caterpillars of the garden tiger moths, rub off the hairs from their bodies, with which they are so plentifully supplied, that they have obtained the ordinary names of woolly bears, and spin them into the substance of the cocoon in a very ingenious manner, so as not to permit the ends of the hairs to stand upright in the inside of the case, which would, of course, fret the newly disenclosed chrysalis.

The more perfectly constructed cocoons, however, such, for instance, as that of the silk-worm, consist apparently of two distinct portions, externally a loose gauze-like covering, and internally a closely woven and compact ball of an oval form. As the insect works from the out to the inside of its case, the former is of course first spun, but the whole is formed of a single thread, disposed in two different ways; and here may be noticed the interesting circumstance, that although the threads of these cocoons are fastened together with gum, they are yet so slightly adherent, that they may be easily unwound; if their union were more perfect it would be impossible to divide the thread, which is as easily unwound as that of a ball of cotton, but it is one of the essential qualities of the gummy matter with which the thread is coated, that it dries very quickly, so that no sooner is it emitted from the spinnerets, than it is almost dry, before it reaches the layer of threads upon which it is about to be placed. According to Malpighi, six distinct layers of silk are distinguishable in the cocoon of the silk-worm, but Reaumur suspects there is often a greater number; be this however as it may, a single thread may be unwound from it more than a thousand feet long.

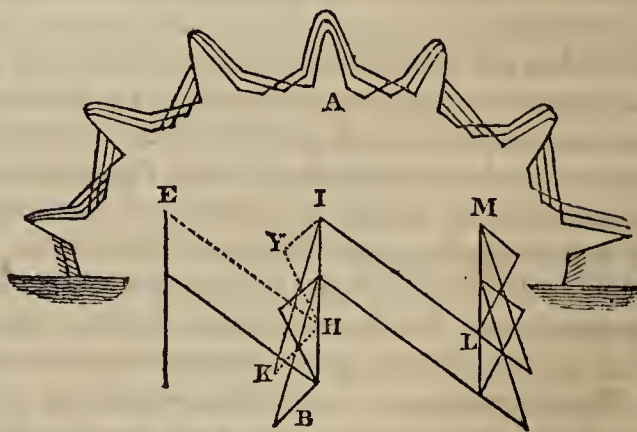
Many interesting instances of the manufacture of various kind of cocoons, not only composed of silk, but also of silk and other materials, as leaves, moss, earth, &c., are detailed by Reaumur and De Geer, and which are introduced into the "Introduction to Entomology," and the "Insect Architecture." We

trust, therefore, that our readers will feel more interested in the two following instances, to which, together with the account of the proceedings of the *Bombyx Promethea* (see vol. i. p. 748), we shall confine our notice of this branch of the subject, premising only, that much remains to be discovered, and that a wide field of interesting inquiry is open, for the investigation of those who prefer looking at the workings of nature, to the mere getting together of a collection of specimens.

The first of these instances is recorded by Lyonnet in his posthumous researches lately published, and relates to the *Tinea sequella* of Fabricius, a very small moth, having the upper wings of a white satiny ground, from the base to the middle, with darker markings formed of small scattered black dots. Its caterpillar is extremely small, not exceeding one-sixth of an inch in length, and is found on the under-side of oak leaves. Lyonnet, who had observed the proceedings of many caterpillars in forming their cocoons, nevertheless says of this, that it "emploie une adresse *inconceivable*" in forming its case, which is of a white colour, and of a long oval form, having its upper surface ornamented with seven upright ridges. Unlike most cocoons, however, it is applied along the under side to the leaf upon which it is placed, so that it forms only an arc of a circle. The first step taken by the larva is to erect about a score of small upright silken palisades, arranged in an oval position all round its body; these are in no ways employed in the construction of the cocoon itself, and seem only to be erected to defend the larva whilst working. Near to one end of this inclosure, the larva now commences its cocoon in the manner represented in the following figure.



The mode in which the ridges of this cocoon are formed with perfect regularity, is indeed inconceivable. Some idea may however be obtained of it from the two following figures.



Here M, I, E, represent three longitudinal ridges, and MI, IE, the intermediate space; the caterpillar commencing at E, extends a thread to H, from H to I forming an angle, from I it then proceeds to K, and from K to H, forming another acute angle, and then from H to Y, and Y to I, forming another obtuse angle. It then proceeds in the same manner from I

to M, as it had from E to I, and in this manner proceeds until it has nearly formed half its case, when turning round, it begins at the other end, and at length unites the two halves together, "thus inclosing itself," as Lyonnet says, "en une jolie cage" of network, which occupies only half an hour in the construction, but which is subsequently rendered much more firm by a strong layer of silk within.

The other instance which we propose to notice, is that of another small moth (*Microsetia ruficapitella*), the larva of which forms the curious lines of a brown colour, often to be noticed upon rose leaves, by eating away the internal fleshy part of the leaf, leaving the two surfaces entire. When full grown it eats its way out of the leaf, and crawls down the branches and stem, until it has found a convenient place to fix its cocoon, which is formed by stretching out its body, and attaching a thread to the branch; it then crosses its body to the other side, and there fastens it. By proceeding thus on all sides, keeping the hinder part of the body fixed, it forms the upper part of the cocoon, or that exposed to the weather, which is convex, and generally circular; the under part is oblong-shaped to hold the pupa, and much smaller than the upper, which projects considerably beyond it on all sides, so as to form a defence against the rain, somewhat after the fashion of a parasol. At one end the threads are not interwoven, and leave a space through which the pupa can force a passage. This remarkable cocoon is very flat, and at first of a pure white, but soon assumes a dark colour. It is formed towards the end of October, and the moth appears in the middle of the following May. It is an elegant little creature, the upper wings being gold coloured, with the extremity purple, and the head red. The expansion of the wings is nearly a quarter of an inch. E. W. Lewis in Entom. Mag., vol. i.

COCOS (Linnæus). A genus of palms, and certainly the most useful of all of them to the inhabitants of the countries where the trees naturally grow. Linnæan class and order *Monœcia Hexandria*, and natural order *Palmæ*. Generic character: flowers androgynous, that is, male and female are on the same plant; calyx of three sepals; corolla of three petals; stigmas sitting; drupe fibrous, shell with three pores at the base; kernel equal in thickness, and hollow; embryo within the pores at the base.

This magnificent tree gives a peculiar character to the scenery of the country to which it is indigenous. The vast number of the trees crowded together, the height and equal diameter of their branchless stems, the spreading tuft of fronds which crown the head like an immense umbrella, together with the bunches of fruit suspended from among the footstalks of the fronds, forms altogether a spectacle the most imposing. The coast of the beautiful island of Ceylon, and that of Coromandel from Cape Comorin to Balasore at the mouth of the Ganges, is embellished with groves of cocoa-nut trees at shorter or longer distances from each other. To the voyager along these shores, the tree under notice is certainly the most prominent feature, and when he lands and enters a grove of them he feels astonished at their numbers and height.

The tree serves many purposes of the inhabitants. The regular form of the stem makes it easily convertible to the purposes of building, fencing, or the like; and though the grain is exceedingly porous and coarse, the wood is notwithstanding very durable. The leaves or fronds make excellent thatch for their

huts; the outer covering of the nut, after being macerated or soaked in water long enough to dissolve the pulpy cellular matter, leaves the mass of fibres, after some further preparation, fit for spinning into cordage, coarse wrappers for packing, and many other purposes. The shells are easily manufactured into various sorts of cups, &c., and converted into button-moulds, for which last purpose the substance is suitable, except that it discharges a brown colour when used on white or light coloured garments. When the nut is quite ripe, by opening one or two of the bottom pores, a fine pleasant flavoured fluid issues which is called "milk," and when the nut is split, a part not so fluid as the milk, nor so solid as the kernel, and easily scraped off with a spoon, is called the "cream," accounted a delicacy. Next follows the kernel, serving for more substantial food, and which many partake of as diet.

But the principal use of the tree to the inhabitants of India is the refreshing beverage drawn from it, and after fermentation drank under the name of "toddy." To obtain this, a part or the whole of the raceme of fruit is sacrificed. Soon after the fructification appears and begins to bend downwards below the fronds, the point is cut off, and to the stump is slung a pitcher-like vessel to receive the flow of sap from the wound. When one vessel is full it is replaced by an empty one, and this is continued so long as the sap flows freely. The place where this drink is manufactured is called by the English "a Toddy Tap," and where any one may be supplied with a draught on very low terms. The labourers who attend the bleeding of the trees have perhaps a score or two under the operation at the same time, so that considerable quantities are got together in a large vessel to be fermented at once.

This drink is most suitable for labourers and travellers in such a warm climate, for while it allays thirst it does not inebriate, a circumstance of no small advantage to the tippler, as almost all are inclined to be in that thirsty land. But here the art of the distiller is brought into action: an ardent spirit may be drawn from the toddy, which serves for other and far less sanatory purposes than merely quenching thirst.

Another valuable extract is procured from the cocoa-nut, namely, an useful oil, which is manufactured and sold at a reasonable price. The Cingalese, it is said, have a mode of extracting some nutritious matter resembling sago from the heart of the stems, but the process has not as yet been clearly detailed.

The cocoa-nut has the property of keeping sound for a long period; it has consequently been readily transmitted to every clime where it has a chance of succeeding. Already the West Indies and other warm parts of America possess the cocoa-nut in abundance, and from thence and other places Europe is supplied with the nuts in great plenty. It may here be asked, how do the almost naked natives manage to climb those lofty and branchless trees so readily? This is a very simple though expert manœuvre. The climber first binds his ankles together with a soft bandage, the toes turned outwards, so that the hollow of each foot may cling to the circular surface of the tree. His head and upper part of his body is raised through a strong collar of rope which surrounds both the body of the tree and that of the man. This collar is rather slack and held on each side by the hands, the body being sustained by that part of the rope which passes round the climber's

loins. The first movement is leaning back on the collar and lifting the feet one step upwards, next by a sudden spring of the body towards the tree he jerks up with his hands at the same instant that part of the collar on the opposite side of the stem, by which he gains a higher hold. These alternate movements enables the climber to raise himself to the height of forty or fifty feet or more in a few minutes. The empty vessel which is slung at his back while he ascends is exchanged for the full one at top, and the last brought down to be emptied. The climber descends by reversing the movements he employed in ascending with considerable celerity and in perfect security. Without this mode of climbing it would be impossible to get either toddy or the nuts when wanted, applying ladders to such lofty trees is totally out of the question, for they could not be used in such woods.

The cocoa-nut plant is raised from the nut and kept in hothouses, but requiring much room are inconvenient in such collections.

CÆLIOXYS (Latreille). A genus of hymenopterous insects, belonging the division *Aculeata*, subdivision *Mellifera*, and family of the bees, having the scutellum bidentate, the wings with only two complete sub-marginal cells, and the body destitute of polliniferous organs; the abdomen, moreover, is of a conical shape (whence the derivation from the Greek of the generic name); in the males, also the extremity of this part of the body is toothed, and in the females it is cleft and gaping. From the want of organs for collecting pollen, these insects are evidently parasitic; indeed the Count St. Fargeau states, that it is chiefly in the nests of several of the woolly-bellied bees, *Megachile*, *Anthidium*, *Osmia*, &c., that, cuckoo-like, they lay their eggs. The genus, although containing not more than a dozen species, is distributed over the different parts of the world. They are often to be found on flowers. There are three or four British species, including the type, *Apis conica* of Linnæus, the female of which differs so much from the male, that it was considered by that author, as well as Fabricius, as a distinct species. It is of a black colour, with the abdominal segments margined with white.

CÆLOGYNE (Lindley). An orchideous genus from the East Indies. Linnæan class and order *Gynandria Monandria*; and natural order *Orchideæ*. Generic character: sepals distinct, spreading, the exterior ones oblongly egg-shaped, interior linear; labellum hollow, three-lobed, fringed, double crested, and articulated with the column; column kneed and winged; stigma two-lipped. This, like its congeners, has curious flowers, grows well in loose turfy moor earth, and does better in a frame or pit than in a house. It may be increased by division of the root.

COFFEA (Linnæus), is the tree which yields the fruit, of which the favourite beverage, coffee, is made. Linnæan class and order *Pentandria Monogynia*; natural order *Rubiaceæ*. Generic character: calyx small and five-toothed; corolla funnel-shaped; throat naked; stamens protruding; stigma divided; berry two-seeded. This celebrated plant is named from a place where it grows spontaneously, namely, near the town of Caffa, in Arabia. It is now extensively cultivated in many of the European colonies, both in the East and West Indies; and indeed in every climate suitable to its growth. The tree is middle sized, of a light regularly branched habit,

and formal outline. The berries are collected by hand, dried, and manufactured till fit for use. The coffee plant thrives well in our stoves, and if allowed plenty of pot-room and water, with the necessary temperature, flowers and fruits abundantly. It is increased by cuttings, which, according to Mr. Sweet, come into flower sooner than seedlings.

COLCHICUM (Linnæus), is the meadow saffron of English writers. It belongs to the sixth class and third order of the sexual system, and to the natural order *Melanthaceæ*. The meadow saffron or colchicum are bulbous rooted plants, and found in many parts of Europe. Their flowers have a strong external resemblance to those of the crocus, though they differ much in botanical character. One is a native of Britain, producing the flower in autumn, and followed by its large foliage in the spring. They are chiefly met with in meadows of diluvial soil; but are not esteemed by farmers as a pasture plant, from the supposition that the leaves are injurious to dairy cows. A powerful medicine is prepared from the bulbs. The garden varieties and species are increased by seeds or offsets.

COLEOPTERA (Aristotle, Linnæus; **ELEUTHERATA**, Fabricius). An order of insects of very great extent, having the wings inclosed in a case, composed of a pair of scaly pieces, meeting along the back in a straight line. The wings themselves are of a large size, and of a membranaceous texture, and when unemployed are shut up in several transverse folds, the first of which occurs beyond the middle. These scales are termed elytra, and shutting upon the back, they conceal the upper surface of the abdomen, as well as the wings, from view. The insects themselves are for the most part known by the name of beetles, although the term is not exclusively applied to them. Thus the blister-fly (*Cantharis*) is a coleopterous insect, as well as the turnip-fly (*Haltica nemorum*). If we examine a butterfly, a bee, or a dragon-fly, we shall at once perceive that the elytra of the latter do not exist as such, but that their place is occupied by a pair of large wings, of similar consistence with the following, and being equally with the latter destitute of folds. Comparing these insects with any coleopterous insect, as for instance a cockchaffer, it will be easy to perceive the latter distinguished by the following character. *Wings two, membranaceous, folded transversely beneath two horny elytra*, which character precisely corresponds with the Greek name *Coleoptera*, and the Latin one of *Vaginipennes*, given by the Latin naturalists to these insects. As, however, we attend to more minute differences of structure, we perceive the necessity of still more rigorously fixing the limits of our groups, by the employment of other characters, without which we should confound the locust, the grasshopper, the cicada, and the cimex, with the coleoptera; and indeed in the early works of the great Swede, Linnæus united the two former insects, together with the generality of those which form the modern order of *Orthoptera*, with the beetles. And even in his last work, we still find the earwig united with them, although the others were separated to form the ill-assorted order of *Hemiptera*, which order Linnæus had at first well defined, to comprise only those species which have an elongated tubular rostrum, articulated and bent beneath the breast. Now the coleoptera, as well as the orthoptera, differ from these in having the mouth formed of jaws and other organs for mastication. If therefore to the

above character we add, *mouth with jaws*, all doubt as to the admission of the hemiptera is removed. An attentive comparison of the wings and wing covers, would unquestionably have led to the same result; but that now mentioned is not only much more simple and uniformly existent, but is also evidently dependent upon much more important considerations than the form of the wings and elytra. In like manner the differences existing between the oral organs of the coleoptera and the orthoptera might be resorted to, but another and more important character is at hand. Thus the orthoptera, in their passage to the perfect state, undergo no other change than the casting of the outer skin, and the gradual development of organs of flight, whilst in the coleoptera the metamorphosis is complete, and the pupa state quite inactive. Hence by the addition of the character, *metamorphosis, or rather pupa, incomplete*, we have three leading characters, which will not only separate the coleoptera from the fly, the butterfly, the cimex, &c., but also from those insects which have been by some authors united therewith. It is to be observed, however, that the first of the above characters does not exist throughout the entire order; thus in certain, although few instances, both wings and elytra are entirely wanting, as in the glow-worm and the female drilus; in others the elytra, though existent, are soldered together without any wings being concealed by them, as in many of the *Carabidæ*, *Blapsidæ*, and other terrestrial darkling beetles, which have no use for wings. There are in like manner to be found exceptions to the transverse folding of the wings, in the *Buprestidæ* and some of the longicorn beetles, whilst in *Meloe* one elytron partly laps over the other, and in *Sitaris*, *Rhipiphorus*, &c., the suture is not straight, the elytra not shutting together, whilst in *Atractocerus*, *Molorchus*, &c., the wings are not covered by the wing covers, from the reduced size of the latter. Still there are sufficiently strong indications of direct affinity between all these insects, and others belonging strictly to the order, so that it is impossible not to perceive that they equally belong to it, although they form exceptions to *one* out of *several* of its leading characters.

Scarcely any branch of natural history has been so much investigated as this order of insects; indeed many students, as well as amateurs, have exclusively devoted themselves to this group. The amazing variety of form; the richness or agreeable disposition in their colours; the great number of modifications which their external organisation presents to our view, and which consequently afford so many additional aids towards their classification; the circumstance that these animals generally surpass in size the remainder of the class to which they belong, and the ease with which they are preserved, owing to the greater consistence of the outer covering, all tend to render the coleoptera interesting to the student; but to these circumstances may be added the vast extent, as regards the number of species contained in the order. It would, indeed, be difficult correctly to judge of the number of these insects, distributed over the surface of the globe, each arrival from foreign climes bringing hosts of novelties to our cabinets; and not only is it from the little frequented countries either of the old or new world that these importations are derived, but every year adds considerably to the lists of our indigenous species, by the discovery of undescribed beetles. Many persons have hence been

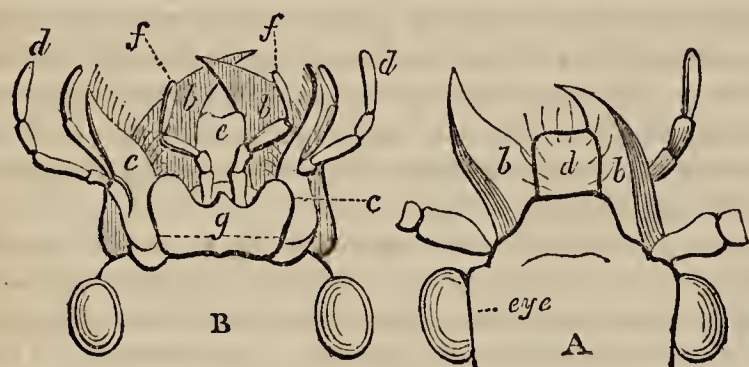
induced to believe, that a new creation was constantly going forward, or that from the admixture of species, hybrids were produced. The latter is a difficult question to solve, but analogy, derived from well authenticated and long known species, induce us to object to such an idea. In order to account for this introduction of novelties, it is to be noticed, not only that the number of actual collectors of insects is wonderfully increased, as well as the modes of collecting greatly improved; moreover, in all our large maritime and commercial towns, the productions of foreign climes are to be found in great abundance, and with them are evidently introduced an immense number of wood, plant, or grain-feeding insects, which in favourable circumstances multiply and become acclimated amongst us; hence it happens that the vicinity of large towns exhibits a richer list of species than more thinly peopled districts.

It is however unquestionable, that the coleoptera exceeds in point of number of species, any other order of insects, although the diptera and hymenoptera, now that more attention is being bestowed upon the minute species, are not far behind the beetles in point of numbers. The French collections are estimated to contain not fewer than 30,000 distinct species of coleoptera, and it is by no means improbable that at least 20,000 more are contained in the cabinets of other countries, wanting in the former. Thus 50,000 species may be considered as actually existing in our collections; and when it is known that immense tracts of country in Asia, Africa, North and South America, New Holland, and the Islands of the Southern ocean exist, from which not a single insect has been received, we may without exaggeration conclude that there are from 100,000 to 150,000 species of beetles in existence. This number, however, will scarcely be considered overrated, when it is further mentioned that in our own little island upwards of 3,500 native species have been actually described.

In the series of insects the coleoptera also seem to possess a certain degree of superiority, which places them in the foremost ranks of the class to which they belong. An eminent French naturalist, M. Marcel de Serres, has not indeed adopted this opinion; the orthoptera, whose anatomy he has profoundly investigated, being in his ideas entitled to be placed at the head of the class, his opinion being founded upon a consideration of the superior development of the locomotive organs. Latreille however has considered that too much weight has been given to this character, and has suggested, from a *general* consideration of their comparative anatomy, that the coleoptera are the most perfectly organised of insects, and consequently as being entitled to the highest rank.

We will now proceed to give a rapid sketch of the external anatomy of these insects. The body consists of the head, a large segment which has been generally termed the thorax, two short inconspicuous segments which support the wing covers and wings, and the two posterior pairs of legs, and which form a portion of the true thorax; and lastly, a continuous series of rings which compose the abdomen, and which are not furnished with locomotive organs. The head is generally of a rounded form, furnished with a pair of antennæ, extremely varied in their form in the different families, but which in the majority consist of only eleven articulations; they often differ in the sexes,

those of the males being larger, longer, or laterally more developed than in the other sex. The eyes, which are always composite and faceted, are generally larger and globular in the carnivorous species, as well as in those which, from the slowness of their habits, have great need of defence against their enemies. Some species have been asserted to possess the simple eyes (*ocelli*), observed in the hymenoptera, &c.; but Latreille does not consider that any species possesses these organs; and indeed, as he is induced to suppose from a comparative examination of the eyes of insects, that the presence of these ocelli is an indication of optical weakness, their non-existence in the coleoptera seems to confirm his opinion of the superiority of these over other insects. The mouth consists, as in all masticating insects, of an upper lip (labrum, *a*), a pair of horny jaws moving horizontally (mandibles, *b*), two other jaws (maxillæ, *c*) of a less firm consistence, but more complex in their organisation, bearing a palpus (*d*) or feeler, and furnished moreover with a lateral lobe, which occasionally assumes the appearance of an additional palpus, and lastly a lower lip (labium, *e*), furnished with a pair of palpi (*f*), and implanted upon a broad horny basal piece, which is termed the chin or mentum (*g*).



The thorax, as usual, consists of three segments, but the first of them, or the prothorax, is so much developed at the expense of the second and third, that the only conspicuous part in the meso-thorax (or second segment), is the part usually termed the scutellum, whilst the meta-thorax (or third segment) is reduced to a short and almost obsolete ring, giving support to the pair of wings and the third pair of legs. The legs articulate with the posterior extremity of the segments, to which they are attached beneath, by means of a short piece termed the trochanter, which in the hind legs is more voluminous, forming indeed, occasionally, a large plate, sometimes moveable, but at others soldered to the segment, of which it appears to form a part; indeed in the water beetles, the large trochanters of the hind legs have been mistaken by some of our first entomologists for the sternum; this piece is followed by another small joint, the coxa, which is succeeded by the femur or thigh, which is the strongest part of the leg, and the tibia or shank, a piece generally of nearly equal length with, but more slender than, the preceding, the last portion of the leg consisting in an articulated piece called the tarsus, the number of articulations of which varies from three to five. The abdomen is attached to the meso-thorax by its entire breadth, its inferior portion or the belly being always more solid in its consistence than the upper surface, owing to the latter being defended by the wing covers; it is moreover provided on the under side with only six segments, whilst on the upper seven or eight are visible. In some insects, however, as the rove beetles (*Brach-*

elytra), which have the abdomen for the most part exposed, the upper surface is as firm as the lower. The additional segments of the body, two or three in number, which are to be observed in the body of the larva, compose, in the perfect beetle, the organs of generation.

The metamorphosis of the coleoptera, or rather its character, as derived from the state of the pupæ, is termed incomplete. The larva resembles a soft fleshy worm, having the head and upper surface of the thoracic segments scaly, and provided with six legs, attached in pairs to the three anterior segments of the body. The head of the larva exhibits, in an undeveloped manner, nearly all the parts of the mouth of the perfect insect. In the place of the faceted eyes, are to be seen a number of small granular tubercles, which somewhat resemble the ocelli of the hymenoptera, &c., being often six in number on each side of the head. The jaws are much more developed than the other parts of the mouth, which is doubtless owing to the circumstance, that it is in the larva state that the greatest supply of nourishment is taken by the insect. The antennæ are very small and conical, and generally only four-jointed. The more inactive and concealed these larvæ are, the more they exhibit the appearance of a worm; those of the more carnivorous species are generally more alert, and in the rove beetles we have seen that they exhibit very much of the appearance of the perfect insect. The extremity of the body of these larvæ is often furnished with a fleshy retractile tubercle on its under side, which is employed as a seventh leg. When the larva has attained its full size, it generally burrows into the earth, where it hollows out an oval cell, within which it is transformed into an inactive pupa, of an uniform whitish colour, with the wings and legs folded upon the breast. The pupæ of some of the species are, however, naked, as in the *Chrysomelidæ*, whilst others, as *Clythra*, pass this state within the case which had served for their abode whilst larvæ. The duration of these transformations, the habitations and economy both of the larvæ and perfect insect, varies, as may well be supposed, in so extensive a group, in the different families and genera. Arrived at their last state, they possess their full degree of development, and now the reproduction of their kind is their chief employment.

Compared, however, with many other tribes of insects, as for instance the bees, ants, wasps, ant-lions, &c., none or but very few beetles present in their habits any of those extraordinary traits of instinct which have so much engaged the attention of observers in every age and country; still, however, even in this respect they are not without interest, as we have already seen in the articles *CICINDELIDÆ*, *COCCINELLIDÆ*, *CERAMBYCIDÆ*, &c., and as we shall have to show in many other instances.

Hardly any coleopterous insect has been employed in the arts, but it is questionable whether some of the species might not be rendered useful. The meloe and the coccinella emit from the mouth and eyes a gummy fluid of a fine yellow colour, which might be employed in painting. The former insect is of a large size, and sufficiently abundant for experiment, if some of our celebrated chemists would not think the subject beneath their notice. In like manner the *Mylabris*, *Cantharis*, or *Carabus*, might furnish an useful extract of a fine colour. We have already in our articles upon these insects given an account of their

medicinal properties. It is not improbable that many other species possess similar powers. Less useful but highly ornamental, the metallic coverings of many species may be and indeed have been employed in decorating various kinds of trinkets, giving an effect equal to that of gold or precious stones of every shade. By the Indians they are employed to decorate the head-dresses and necklaces, as well as for earrings, &c.; and we have seen, in a large warehouse in London, entire dresses decorated with the elytra of the *Buprestis chrysis*. The larvæ of the *Coccinellidæ* are eminently serviceable in checking the swarms of *Aphides*, whilst the *Silphidæ* and many other insects, by feeding upon decaying vegetable and animal matter, are active agents in keeping up the regular succession of changes in the creation.

The coleoptera have been divided in different manners by various authors. By Linnæus the construction of the antennæ formed the character upon which the sections were established, but the distribution more generally adopted by modern authors is founded upon the number of joints in the tarsi, as follows:—

Sect. 1. *Pentamera*, all the tarsi having five joints.

Sect. 2. *Heteromera*, the four anterior tarsi having five, and the two posterior having only four joints.

Sect. 3. *Tetramera* of the French authors, having apparently only four joints in each tarsus.

Sect. 4. *Trimera* of the French authors, having apparently only three joints in each tarsus.

It is to be observed, however, with respect to the two latter groups, that there is a minute rudimental joint at the base of the terminal joint which has been overlooked, and which renders the names *Tetramera* and *Trimera* incorrect; still the general structure of the tarsus in these two groups is so well marked that we have not hesitated to adopt them; and, secondly, that the section *Dimera* founded upon an incorrect examination of insects supposed to have only two joints (the *Pselaphidæ*, see BRACHELYTRA) is equally incorrect, and consequently rejected.

COLIAS (Fabricius). A genus of lepidopterous insects belonging to the section *Diurna* and family *Papilionidæ*, or true butterflies, having the hinder wings extended beneath the abdomen, so as to form a kind of canal on which this part of the body rests, the claws of the feet are small and bifid, each having two equal sized hooks; the palpi are short and very much compressed; and the antennæ are terminated by an elongated conical club, gradually increasing to the tip. The anterior legs, which in some of the butterflies are of a small rudimental size, are here fully developed. The caterpillars are fleshy and cylindrical, without either tubercles or the fleshy forked tentaculæ which arm the neck of the larvæ of the genus *Papilio*. These butterflies, which formed portion of the Linnæan section *Danai candidi*, are more gaily coloured than the allied insects composing the genus *Pontia*, including the common white butterflies, being especially distinguished by the bright yellow or orange colour, which in a remarkable degree pervades the whole group, thus evidencing the curious fact of the prevalence of peculiar colours in peculiar groups of animals. The genus is likewise interesting on account of another peculiarity. "Several papilionaceous insects," observes Mr. Stephens, "are remarkable for their periodical or irregular appearance, and none more conspicuously so than the insects of this genus.

The cause of this interesting phenomenon appears inexplicable, its solution has baffled the inquiries of entomologists, and several speculative opinions have been advanced thereon. By some persons their sudden increase has been attributed to the previous failure of their natural enemies, the ichneumons and the soft-billed birds; by others to an increased temperature; others again suppose that their eggs lie dormant till called into life and vigour by some extraordinary latent coincidences. But all these opinions are mere conjectures, and they do not sufficiently clear up the difficulty, which is rendered more obscure from the fact that several of the insects, especially *Cynthia cardui*, appear constantly in some parts and periodically in others."—*Illust. Brit. Ent.* vol. i. p. 10. The genus is a very extensive one, as regards the exotic species, but great confusion has occurred respecting the English ones. Thus whilst Stephens gives four, Curtis admits only two. We will not enter into the points involved in the determination of these questions at issue, further than to mention that, besides several other minor points of inquiry, the limits of specific variation, as well as the geographical range of insects (two most interesting subjects), are both included therein.

COLIUS—Coly. A genus of birds, regarded as being wholly or chiefly granivorous, and as such ranged by Cuvier in the conirostral division of his great order *Passeres*. All the known species are African birds dwelling chiefly in bushes and thickets, and we are but little acquainted with their manners. The name signifies "little crow."

The characters are: the bill thick, short, stout, convex above, flat below, a little compressed towards the point, upper mandible lapping over the edges of the lower one; nostrils small, basal, lateral, round, partly covered with feathers, and pierced in the horny substance; feet of mean size, with four toes, three to the front, united to the first joint, external toe longer than the tarsus, the hind toe short and reversible, and the claws very crooked; the wings very short, the first quill merely rudimental, the second shorter than the third which is the longest in the wing.

These birds are confined to the tropical regions of the old continent, though they, or others very much resembling them, are also met with in Australia. Being bad fliers, and capable of only short flight, these birds seldom venture out of the shade of the trees, but prefer running along the branches, which they do with great dexterity. They are said to eat buds and fruits, and to refuse insects; and therefore they are very annoying to various kinds of cultivated fruits, and are attacked with great avidity by cultivators.

From the weakness of their wings, these birds are incapable of making long migrations, or proceeding to any considerable distance from the woods in which they have their principal residence and where they build their nests, as the structure of their feet is not well adapted for walking, any more than their wings are for flight. They live in societies, and every bush contains a considerable number of families which build their nests close to each other in the very centre of the bush, which is done to protect their young from birds of prey. The eggs are three or four in number, in each more of a reddish or brownish colour according to the species. When it is not nesting time, these birds repose perching; and it has been said that, in order to sleep the more soundly, they suspend themselves by their claws with their head

downwards, the descent of the blood to which stupifies them so much that against morning they are easily captured. It does not appear that there is much truth in this; for the vascular system of those animals which repose in an inverted position is always so contrived that they can bear that position without any injury. As many as eight species of these birds have been described, varying in length from about a foot to half that measure, and differing considerably in colours; but the particulars of them are too imperfectly known to be of much interest to the general reader.

COLLETES (Latreille). A genus of hymenopterous insects belonging to the section *Aculeata*, sub-section *Mellifera* or bees, and the family *Andrenidæ* or short-tongued bees. The insects composing this genus do not live in society, and consequently there are no neuters; the basal portion of the lower part of mouth (*mentum*) is long, but the fleshy part at its extremity is short and bilobed, having two lateral fleshy and slender appendages; the upper wings have three complete submarginal cells, of which the second and third are of nearly equal size, each receiving a recurrent nerve, and the body is hairy. This genus of bees, of which there are three or four British species (including *Apis succincta*, Linnæus, the type of the genus), presents several interesting peculiarities both of structure and habits. In our first volume (see pp. 361, 362) the mouth of the hive bee is figured, the terminal parts of which will be seen to be of a very elongated form; but in the genus of bees now under consideration these parts are so very short that in this respect it much more nearly approaches the wasps than it does the bees, and accordingly Mr. Kirby places it at the commencement of the family. And here we may take the opportunity of correcting an error which unavoidably occurred relative to the figures above referred to. At p. 362 three views of the mouth of the bee are given in the progress of gradual extension. These should have been succeeded by the figures of the "bee's mouth" in p. 361, which represent the same organs still more completely extended, but which were accidentally misplaced, so as apparently to illustrate the structure of the mouth of the larva, after the description of which they are placed. In the left hand figure of the two last mentioned, the tongue and its various parts are more protruded than in figure 3, the different organs on the left side of the figure being laterally extended, whilst the right hand figure represents the mouth at its greatest possible extension.

The peculiarity above noticed in the structure of the mouth of the colletes, seems calculated, as Mr. Kirby well observes, in his invaluable monograph upon the English bees, to assist it in the construction of the membranaceous cells, which the wise Author of nature has instructed it to form for the reception of its eggs; an account of which, from the work of Reaumur, he introduced into his monograph, without, however, having been himself fortunate enough to meet with the nests. The author of this article has been more successful than Mr. Kirby, having more than once discovered the nests, and reared the colletes, and can therefore testify to the correctness of Reaumur's account. Our nests were, however, found in hot sandy banks, thus differing (perhaps from a difference in the species) from those observed by Reaumur. They make their nests, as the latter author informs us, in the earth that fills the vacuities of certain stone walls; some of

them choose a northern aspect sheltered by trees; these nests are cylindrical, and consist of from two to four cells, placed end to end, each of which is shaped like a thimble, the end of the second fitting into the mouth of the first; the cells are not all of an equal length, some being five, others only four lines long; their diameter is about two lines. The cylinder usually runs in a horizontal direction; but sometimes, from the intervention of a stone or other obstacle, it takes a different course, so that the last cell or cells form an angle with the first; it is distinguished by transverse bands of different colours. The cells are composed of many layers of a very thin and transparent membrane; the red colour arises from the substance with which they are replenished, this is sometimes nearly liquid, at others it is merely a paste made of pollen and honey. After the larva is hatched, it soon imbibes all that is liquid, and when arrived at its full dimensions, it quite fills its cell; it resembles the larva of the hive bee. Whence these bees procure the membrane with which they form their cells, our author could not ascertain, but he conjectures it to be a secretion of the insect, analogous to that used by many others for similar purposes. Grew, in his Book of Rarities, gives the history of a bee supposed to belong to this genus, from the similar nature of the cells, which he says are admirably placed for warmth and safety, &c., lengthways one after another, in the middle of the pith of an old elder branch, with a thin boundary betwixt each bag; whilst Willoughby seems to have noticed their nests in similar situations to those which we have found, namely, in sand banks; where he says they burrow, making holes like worm holes.

COLLINSIA (Nuttal). A genus of handsome annuals, natives of America. Linnæan class and order *Didynamia Angiospermia*, and natural order *Scrophularinæ*. Generic character: calyx bell-shaped, five-cleft, persisting; corolla personate, back of the tube gibbous; upper lip erect and cleft, the lower one trifid, the middle division forming a hollow keel; stamens bent downwards, in the hollow of the corolla; anthers placed parallel; style two-lobed; capsule two-celled, four-seeded, and four-valved. These are elegant plants, and if seeds are procured may be treated like hardy annuals. If sown in the autumn, they will flower early and ripen seeds in the following summer.

COLLINSONIA (Linnæus). A genus of tall growing herbaceous plants, belonging to *Diandria Monogynia*, and to the natural order *Labiata*. Being hardy, they grow in any common garden soil, affecting a moist situation, and are increased by dividing the root.

COLOCASIA. The specific name of a large Egyptian arum, cultivated in that country for its tuberous roots. It is common in our hothouses as an ornamental plant, the leaves being large and handsome.

COLOUR is one of the external characters, by which all objects, whether animate or inanimate, may be distinguished; therefore in every department of natural history, it is an important element in classification and description.

In zoology the species and varieties of many animals are principally determined by the colour or colours which they exhibit; in botany, notwithstanding the influence of climate, change of seasons, soil, situation, and other incidental circumstances, every species of

plant has naturally determinate colours, by which it may be recognised; and in mineralogy, each species of mineral presents a particular colour or suite of colours, by which it may also be identified. In meteorology, the aerial tints, the meteors, and the atmospherical phenomena peculiar to certain countries, can only be appreciated by a correct perception of the different colours which characterise their appearance; while in hydrography, a similar power of discrimination is necessary, to describe the varieties of colour which occur in the seas, lakes, and rivers, which adorn while they fertilise the surface of the earth. Hence every naturalist should be well acquainted with the philosophy of colours; he should be able to discriminate them accurately; he should know the effects which their several combinations will produce; and should understand the circumstances by which they may be modified or entirely changed.

The colour of all natural bodies, whether we contemplate the gorgeous hues of sunrise or sunset, the iridescent plumage of a bird, or the tints that variegate the petals of a flower, must be derived either from the light of the sun, or else be inherent, like any other property of matter, in the substance of the bodies themselves, the light in that case being only the passive medium through which their effect is communicated. The majority of philosophers concur in ascribing their origin to some change in the constitution or condition of light, yet their opinion concerning the manner in which this change takes place, must depend entirely on the views they entertain concerning the nature and properties of light. On this subject two theories are at present very ably maintained by their respective advocates; the one termed the Newtonian or molecular; the other the undulatory theory of light; each of which is signally ingenious and beautiful in detail, and alike supported by men of the profoundest mathematical skill. According to the Newtonian or molecular doctrine, light is presumed to consist of an infinite number of very minute particles of matter, which proceed in a continuous stream from the sun, or any other luminous body, and which, impinging on the nervous filaments of the retina, with such rapidity, as to allow of no sensible intermission of the impression they excite, induce the sense of vision. On the other hand, according to the undulatory hypothesis, light is supposed to consist simply in the undulations of an exquisitely subtle and elastic medium or ether, which pervades the whole universe. The waves of this medium, according to the impulse communicated to them by the action of what are called luminous bodies, reach the nerves of the eye and excite the sensation of sight, in the same manner as the sensation of sound is excited in the nerves of the ear by the vibrations of air. In the history of science, never perhaps were two theories proposed to explain the same phenomena, in which the evidence in favour of each appears to be so fairly balanced; yet to understand how either may be applied to explain the origin of colours, we must revert to certain properties of light which are immediately connected with this interesting investigation.

Whether the molecular or undulatory theory be adopted, light is observed to move in straight lines, until intercepted in its progress by passing from a medium of one density into a medium of another density; or until interrupted by impinging against

some semi-transparent or opaque body. In passing from air into water, the rays of light on entering the fluid are observed to deviate from their previous rectilinear direction; they appear to become bent, and this deviation from the straight line is called the refraction of light. Hence when an oar is immersed in water, it appears distorted on account of the rays of light by which it is seen being refracted or bent, on emerging from the water. The extent, however, to which the light deviates from the rectilinear direction varies in different media; thus, as the atmosphere which surrounds the earth, is denser in its lower than in its upper regions, the light of the sun, in passing from the rarer into the denser strata, becomes more and more bent or refracted; so that it descends to us in a vertical curved line, for which reason the moon and stars appear to us at a greater altitude than they really are; for which, in astronomical and trigonometrical observations, allowance is always made. The rays of light, however, are not refracted if they fall perpendicularly on the denser medium; hence the refraction becomes less as the sun approaches to the zenith, and increases as it descends towards the horizon; accordingly, in the blaze of noon the sun's rays are reflected with silvery and dazzling whiteness from the surface of the waters, whereas towards evening, as the sun gradually sets its rays, falling obliquely upon the waters, the waves become illuminated with all the beautiful prismatic colours of the refracted light. Again, when light impinges upon any solid body, it is either almost entirely transmitted through it, in which case the body is transparent, or it is reflected or driven back at a certain angle, just as a marble after striking against a wall is reflected, or driven off again; and this is what is termed the reflection of light. The surface of metals which are highly polished, or glass quicksilvered at the back to prevent the transmission of the rays, are the best reflectors; as are also all white surfaces. When the earth is covered with snow, and all objects are shrouded in the same wintry garment, the snowy crystals reflect the sun's light so vividly in all directions, as to excite acute pain in the eye, an inconvenience much complained of by navigators, who have endeavoured to explore the dreary solitudes of the Polar Regions. Even the Esquimaux, and other natives of those snowy wildernesses, are obliged to protect their eyes from this reflection of the solar rays, by a sort of wooden shade which is commonly worn among them. To these two properties—refraction and reflection—we owe the uniform diffusion of light through the atmosphere; indeed, had the atmosphere, instead of possessing regions of different density, consisted of an unlimited homogeneous medium, the sun, the moon, and the fixed stars, would have appeared to shine in a firmament of darkness; so exquisitely adapted is the air we breathe, and the sunbeam which illumines our path, to the general economy and beauty of the universe. There is yet, however, connected with air, water, and other media through which light may be transmitted, a curious property to be noticed; viz. when they are sufficiently dense, they absorb a great quantity of the light which enters into them; in other words, the light which falls upon such transparent media, is greater than the quantity which is either refracted or reflected, so that a portion in some way or other becomes suppressed or lost. For this reason, owing to the absorption of the refracted light,

objects become quite invisible at a certain depth below the surface of water. So also on the top of the Andes or Alps, many more stars are visible to the naked eye, than in the valleys or plains below; because their rays having to pass through a smaller extent of air, less of the light which they impart becomes absorbed. These facts are recognised, and different explanations of them proposed by the supporters both of the molecular and undulatory theory of light, and require to be remembered in studying the colours which different natural bodies assume.

It was known to the ancients, that the light of the sun might be so acted upon by different objects, as to exhibit a variety of colours; thus Aristotle ascribed the appearance of the rainbow to the reflection of the sun's rays on the falling drops of rain; and Seneca states, that if the sun shine through a triangular piece of glass, the colours of the rainbow will be displayed. Indeed the exhibition of colours by the prism had often been made previous to the time of Sir Isaac Newton; it remained, however, for that illustrious philosopher to examine the phenomena more critically, and deduce from his analysis, more definite and important inferences than had been previously attempted. His method of proceeding was simple, and may be readily understood. In the first place he darkened a room, admitting through a hole in the window-shutter only a small quantity of light, which was reflected upon the opposite wall. He then, taking the triangular piece of glass or prism, interposed it in the course of the sunbeam, and observed, that instead of being simply directed out of its course, and forming the same circular image which it had previously done upon the wall, an oblong image of the sun appeared, presenting seven different colours. This surprised him, and he states that it "excited in him a more than ordinary curiosity to examine from whence it might proceed;" accordingly, apprehensive that some unevenness in the glass or other incidental circumstance might have occasioned a deception, he repeated the experiment in a variety of ways, yet always with a similar result. He then began to think, that what appeared to be white light must in reality be composed of these seven different colours; to determine this more satisfactorily, he took another prism, and so adjusted it as to refract the light in a contrary direction, so that the primary or different coloured rays were again blended together, upon which the white light was reproduced. Hence he inferred, that what seems to be homogeneous white light, is a combination of seven different coloured rays,—red, orange, yellow, green, blue, indigo, and violet; and he then proceeded to examine these different colours separately. In so doing, he allowed each particular colour to fall on a second prism, and observed that when refracted it was not, as before, drawn into an oblong image, nor into any other colour, wherefore he concluded that each of the seven primary rays of light possessed a specific degree of refrangibility, and that there is an immutable correspondence between the refrangibility of each ray, and the colour it possesses. This comprehends what is meant by the different refrangibilities of the rays of light; for it was observed that the red was less refrangible than the orange; the orange than the yellow; the yellow than the green; the blue than the indigo; and that the violet was the most refrangible of them all. The different colours so exhibited form what is described as the solar spectrum; but it

is to be observed, that by Sir Isaac Newton's analysis no lines or boundaries between the different colours were perceptible; the colours appearing to be shaded off by imperceptible gradations into one another, and he determined their relative proportions by the individual length or spaces they occupied. It has since been ascertained by Dr. Wollaston, aided by Fraunhofer, that when the prism is perfect, and the light admitted through a very small aperture, the spectrum received on a sheet of white paper will exhibit the prismatic colours, divided by an indefinite number of dark and sometimes black lines, which in all spectra formed by solar light, preserve the same intensity and relative positions, so that they may be esteemed fixed points for ascertaining the refractive powers of different media. It is worthy however of observation, that they differ with the species of light employed, the spectra of the moon and brighter fixed stars, exhibiting lines peculiar to themselves. Furthermore, it appears that Sir Isaac Newton erred, in not observing that the relations of the coloured spaces must be considerably modified by the angular magnitude of the sun, or luminous body, or the aperture from which his spectrum was obtained; hence his proposition, "that to the same degree of refrangibility ever belongs the same colour, and to the same colour ever belongs the same refrangibility," proves to have been incorrect. The researches of Sir David Brewster have indeed effected a still further analysis of the solar spectrum. Taking advantage of the property which certain coloured media have, of absorbing one or more of the primary rays, this accomplished philosopher has succeeded in reducing the colours of the spectrum to three, viz. red, yellow, and blue; the orange in the spectrum of Sir Isaac Newton, he found to be occasioned by the mixture of the red and yellow rays; the green by the mixture of the blue with the yellow rays. His investigations appear to have established the following facts concerning the composition of the solar spectrum. 1. White light consists of three simple colours, red, yellow, and blue, by the combinations of which all other colours may be formed. 2. The solar spectrum consists of three spectra of equal length, beginning and terminating at the same points, viz., a red spectrum, a yellow spectrum, and a blue spectrum; all other colours in the spectrum are compound colours, each consisting of red, blue, and yellow light, in different proportions. 3. A certain quantity of white light, incapable of being decomposed by the prism, in consequence of all its component rays having the same refrangibility, exists at every point of the spectrum, and may in some points be exhibited in an isolated state.

However the number of colours in the solar spectrum may be thus reduced, the variety of effect produced by their blending with each other can scarcely be brought down to analytical computation. Hence Professor Powell observes, "That a question often asked as to the number of primary colours can only be answered with reference to the sense in which it is asked. If it be meant to apply to the number of tints distinguished in the spectrum, this will be a matter of individual judgment to different eyes. Newton distinguished seven, others four, others three, but perhaps most observers would admit that it is impossible to fix on any number, since the light appears to go through every possible shade of colour between the deep red and faint violet. If we understand the question as applying to the number of

definite points or rays, to each of which a different refrangibility belongs, their number must be considered as infinite. The general view now given of the constitution of light, according to the molecular theory, will enable us to understand the explanation it assigns for the different colours observed in nature.

The principle on which all bodies are supposed to derive their colour is briefly this, that the particles of which they are composed absorb some, and reflect other of the primary and different coloured rays which enter into the composition of white light. The red petal of a rose is presumed to absorb the six other coloured rays, and reflect only the red ray; the blue flower of the harebell to absorb the six other and reflect only the blue ray; and so on with all objects that reflect the different primary rays discoverable in the solar spectrum. Those bodies which reflect several of such rays appear of various colours; those which reflect them all appear white, while those which absorb them all appear black; and the absorption and reflection of the different coloured rays depends, according to the hypothesis of Sir Isaac Newton, on the magnitude of the particles of which the body is composed. Thus the azure colour of the sky is caused by the particles being very small; the green colour of vegetables depends on their being somewhat larger; "the green of vegetables," says Pemberton, one of the most perspicuous of Newton's commentators, "our author judges to be of the third order, partly from the changes they suffer when they wither, turning at first into a greenish or more perfect yellow, and afterwards some of them into an orange or red, which changes seem to be effected by their tinging particles growing denser by the exhalation of their moisture." The change of colour, therefore, which any plant, mineral, or other substance, may undergo, either from the action of light, heat, or vital or chemical changes, is presumed to depend on some alteration which takes place in the size of its component particles, which causes other of the primary rays to be reflected. Instead, however, of the mere size of the particles determining the inflection of one or more of the coloured rays, Sir David Brewster supposes that the particles of bodies, solid, fluid, or aeriform, have a specific attraction for the particles of light; if they exercise a simultaneous and proportional action over all the simple rays, then the body is colourless or transparent; if they exercise a specific attraction only over some of the simple rays, then the body exhibits a determinate colour from the reflection of the other rays, whether blue, yellow, or red. The colours produced by the refraction and reflection of these primary rays are especially observable in the rainbow, in solar or lunar halos, in the glaciers that crown the summits of the mountains in Switzerland, and at sunrise or sunset upon the surface of the ocean. Hence too the colour of the sky, the blue and violet rays being most refrangible are more copiously distributed through the atmosphere than the other rays, while the red rays being the least refrangible are not so frequently transmitted; on account, indeed, of their diminished refrangibility, the most favourable condition of the atmosphere for their refraction is obviously when the least vapour or moisture is suspended in it, and accordingly it is a popular observation that a red sky at sunset is a sign of fine weather the next day. In accordance too with what has been noticed concerning the disposition of certain media to absorb light, the air or vapours suspended in it are observed

often to absorb the red rays; hence the fiery aspect of the sky at sunrise or sunset, and the flame-coloured masses of clouds which are often seen dispersed even to the zenith.

But this is not all, for, independent of the colours of natural bodies thus arising from the absorption and reflection of the primary rays, Sir Isaac Newton referred the colours of the feathers of birds, the wings of insects, the scales of fishes, &c., to the same cause as the colours exhibited by thin plates. It was ascertained by Boyle, and afterwards by Dr. Hooke, that when substances which appear to be opaque are reduced into very thin layers they display the most beautiful colours. This may be familiarly exemplified by the bubbles of the essential oils, spirit of wine, turpentine, or soap and water, which, as they become gradually thin, exhibit the most varied and brilliant tints. So also is it with solid substances. Glass may be blown so thin, or mica split into such fine films, as to display the same lively colours; and on the same principle, the delicate filaments of a feather, the exquisitely fine membrane of an insect's wing, or very thin scales, exhibit similar radiant hues.

The colours, however, of the plates vary according as the rays of light fall upon them; when viewed obliquely, they are not the same as when viewed direct, for which reason the colours in the peacock's tail change as the bird changes the posture of its tail in respect to sight. Hence also the delicate plumage of the little humming bird displays the most exquisitely varied rainbow hues, so that when numbers of them are seen together flitting about a flower, or wantonly describing eccentric gyrations in the sunny air, the perpetual shifting of the colours, as the position of the bird varies, has a most dazzling and brilliant effect. The beautiful colours in the interior of shells are referrible to the same cause, as are also the colours of mother-of-pearl, which, when examined under a powerful microscope, presents a surface covered with minute striæ and parallel waving lines. The explanation of this phenomenon, given by Sir Isaac Newton, was this, that a portion of light is reflected from the upper surface of the thin plate, whether of glass or any other substance; and that the coloured rays are refracted from the adjacent under surface. According, however, to the modern theory, which ascribes the effect to the doctrine of interference, the light reflected from the second surface of the plate interferes with the light reflected from the first, and as these two pencils of light come from different points of space, they must reach the eye with different lengths of paths; and the resulting tint arises from the combination of the pencils.

The Newtonian molecular theory of light, therefore, refers the origin of colours, first, to the decomposition of white light, and the absorption of some, and refraction and reflection of one or more of the primary or different coloured simple rays; second, to the interference of light by very thin plates or fringes, the light in both cases consisting of subtle material particles emitted by luminous bodies.

According to the undulatory theory of light, a very different explanation is given concerning the origin and nature of colours; yet before stating the doctrine it inculcates, we may observe that all the properties and phenomena of light above referred to, its refraction, reflection, and absorption, are upon the undulatory hypothesis satisfactorily explained. As the undulations of the ether are propagated in a rectilinear

direction, on reaching a solid body, part of the undulations must proceed forward into the interstices of the body, and part, as from a new centre of motion, are transmitted back into the air; in the former case they are refracted, and the amount of refraction depends entirely on the diminished velocity of the propagation of the undulations within the refracting medium; in the latter they are reflected; furthermore, when light is absorbed, the ethereal waves are presumed to be broken and scattered in dispersed undulations through the interior of the body (Herschel); hence the ordinary properties of light may by either theory be explained; there are, however, certain phenomena, or appearances which light may be brought to exhibit, which are explicable only upon the undulatory theory, one in particular already adverted to is what is termed the interference of light.

It was shown by Arago and Fresnel, that when two diverging beams are made to cross at a very small angle, instead of giving rise to a double illumination at the point where they mix, they exhibit a space striped with alternate black and bright bands. Here, therefore, we have the paradoxical result of two conspiring rays of light, producing absolute darkness, which is inexplicable by the molecular or Newtonian theory; but which is a direct consequence of the theory of undulations, according to which it is obvious that when two waves, propagated from different origins, meet in such a manner that the hollow of the one coincides with the elevation of the other, and the elevation of the one with the hollow of the other, the two waves must obliterate or destroy one another. Accordingly, the point remaining at rest, where the antagonism occurs must appear dark, the agitation of the ethereal medium being necessary to affect our visual organs with the sense of light and colour. Upon this interference of light the beautiful phenomena of periodical colours, or those exhibited by thin plates, appear also to be dependent. In this case a new divergence is given to some of the waves, while others pass on unaltered.

According, therefore, to the undulatory theory, colour is an effect produced by the vibrations of the ethereal medium, which affects us when in undulation with the sense of light, and the difference of the colours so produced depends on the greater or lesser frequency of the vibrations, the whole scale of colours from violet to crimson lying between vibrations which are four hundred and fifty-eight million millions, and seven hundred and twenty-seven million millions in a second; a proportion it may be observed smaller than the ratio of undulations which takes place in the production of perceptible sounds. As in sound the pitch or note is determined by the frequency of the *aerial* pulses, so according to the undulatory theory the colour is determined by the frequency of the *ethereal* pulses.

Whichever of these theories be adopted, the naturalist should acquire the power of discriminating with accuracy the distinction between every variety of colour, however blended, otherwise his descriptions, whether of animals, vegetables, or minerals, will be imperfect. It is true, that the majority of mankind readily distinguish the more obvious colours, red, yellow, blue; but the combinations these may assume are so numerous, and the tints so delicate, that they cannot be adequately appreciated excepting by a practised eye. Hence an artist will perceive beauties in a landscape which escape the notice of an ordinary observer. It is desirable therefore that the naturalist should commence his studies by learning to distinguish accurately the different colours of natural bodies; he should apply to each of these a definite and correct term, expressing even the very shade it may present; and he should know how the simple and elementary colours may be so combined as to produce the succession of tints observable in shells and minerals, in the plumage of birds, the petals of flowers, and which bathe with beauty at sunrise or sunset the earth, the ocean, and the heavens. He will find that the colours which adorn the face of nature pass in suites into one another; nor can any thing be more exquisite than the effect produced by their blending together in mutual harmony. The eminent Werner directed his attention to forming a nomenclature of colour, which has been adopted by Professor Jamieson, and adapted to the study of botany, zoology, and meteorology, by Mr. Syme. The original suite of colours was by Werner fixed at seventy-nine; but finding the number defective when applied in the study of zoology and botany, it was extended by Mr. Syme to a hundred and ten. "The method of classification adopted by Werner was," says Professor Jamieson, "simple and elegant. He placed together all those varieties which contained the same principal colours in a preponderating quantity, and he then arranged them in such a manner that the transition of the one variety into the other, and of the principal into the neighbouring colours was preserved, so that by mere ocular inspection any person, accustomed to discriminate colours correctly, can analyse the different varieties of colour which occur in the mineral kingdom." In this system as improved by Syme, there are ten principal colours, each of which contains one that is called the characteristic colour; thus snow is the characteristic colour of white, velvet-black of black, Berlin-blue of blue, emerald-green of green, &c., and this characteristic colour is so placed in the scale that, ascending or descending from it, we may trace the colours which are connected by transition. The following is the improved nomenclature of the Wernerian system by Syme; it explains how the gradations of colour are produced, and illustrates them individually by reference to some animal, vegetable, or mineral*.

I. WHITE.

1. Snow white is the characteristic colour of the whites, being free of all intermixture it resembles new fallen snow. Animal, breast of black-headed gull; vegetable, the snow-drop; mineral, Carrara marble.

2. Reddish white (snow white, with a minute portion of crimson red and ash grey). Animal, egg of grey linnet; vegetable, back of the Christmas rose; mineral, porcelain earth.

3. Purplish white (snow white, with the slightest tinge of crimson red and Berlin blue, and a very minute portion

of ash grey). Animal, junction of the neck and back of the kittiwake gull; vegetable, white geranium; mineral, arragonite.

4. Yellowish white (snow white, with a very little lemon yellow and ash grey). Vegetable, hawthorn blossom; mineral, chalk and Tripoli.

5. Orange coloured white (snow white, with a very small portion of tile red and king's yellow, and a minute portion of ash grey). Animal, breast of white owl, or screech owl; vegetable, large wild convolvulus; mineral, French porcelain clay.

6. Greenish white (snow white, mixed with a very little

* Syme on Werner's Nomenclature of Colours.

emerald green and ash grey). Animal, vent coverts of the golden crested wren; vegetable, polyanthus, narcissus; mineral, calc. sinter (forms the transition of white into green).

7. Skimmed milk white (snow white, mixed with a little Berlin blue and ash grey). Animal, white of the human eye-ball; vegetable, back of the petals of the blue hepatica; mineral, common opal.

8. Greyish white (snow white, mixed with a little ash grey). Animal, inside quill feathers of the kittiwake; vegetable, white Hamburgh grapes; mineral, granular lime stone.

II. GREYS.

9. Ash grey the characteristic colour (snow white, with portions of smoke and French grey, and a very little yellowish grey and carmine red). Animal, breast of long-tailed hen titmouse; vegetable, fresh wood ashes; mineral, flint.

10. Smoke grey (ash grey, mixed with a little brown). Animal, breast of the robin round the red portion . . . mineral, flint.

11. French grey (greyish white, with a slight tinge of black and carmine red). Animal, breast of the pied wag-tail. . . .

12. Pearl grey (ash grey, mixed with a little crimson red and blue, or bluish grey with a little red). Animal, backs of the black-headed and kittiwake gulls; vegetable, back of petals of purple hepatica; mineral, porcelain jasper.

13. Yellowish grey (ash grey mixed with lemon yellow, and a minute portion of brown). Vegetable, stems of the barberry; mineral, common calcedony.

14. Bluish grey (ash grey mixed with a little blue). Animal, back and tail-coverts of the wood pigeon; mineral, limestone.

15. Greenish grey (ash grey mixed with a little emerald green, a small portion of black and a little lemon yellow). Animal, quill feathers of the robin; vegetable, bark of ash tree; mineral, clay-slate wacke.

16. Blackish grey (ash grey with a little blue, and a portion of black). Animal, back of nuthatch; vegetable, old stems of hawthorn; mineral, flint.

III. BLACKS.

17. Greyish black (velvet black with a portion of ash grey). Animal, breast and upper part of the back of the water hen; mineral, basalt.

18. Bluish black (velvet black, mixed with a little blue and blackish grey). Animal, largest black slug; vegetable, crowberry; mineral, black cobalt.

19. Greenish black (velvet black, mixed with a little brown yellow and green). Animal, breast of the lapwing; mineral, hornblende.

20. Pitch or brownish black (velvet black, mixed with a little brown and yellow). Animal, guillemot, wing-coverts of the black cock.

21. Reddish black (velvet black, mixed with a very little carmine red, and a small portion of chestnut brown). Animal, spots on the wings of the tiger moth, breast of the pochard duck; vegetable, berry of the fuchsia coccinea; mineral, olivine ore.

22. Ink black (velvet black, with a little indigo blue in it). Vegetable, berry of the deadly nightshade; mineral, olivine ore.

23. Velvet black (the characteristic colour of the blacks, colour of black velvet). Animal, mole, tail-feathers of the black cock; vegetable, black of red and black West Indian peas; mineral, obsidian.

IV. BLUES.

24. Scotch blue (Berlin blue, mixed with a considerable portion of velvet black, a very little grey and a slight tinge of carmine red). Animal, throat of the blue titmouse;

vegetable, stamina of single purple anemone; mineral, blue copper ore.

25. Prussian blue (Berlin blue, with a considerable portion of velvet black, and a small quantity of indigo blue). Animal, beauty spot on wing of the mallard drake; vegetable, stamina of bluish purple anemone; mineral, blue copper ore.

26. Indigo blue (Berlin blue, a little black, and a small portion of apple green). . . . Mineral, blue copper ore.

27. China blue (azure blue, with a little Prussian blue in it). Animal, rynchites nitens; vegetable, back parts of gentian flowers; mineral, blue ore from Chessy.

28. Azure blue (Berlin blue, with a little carmine red). Animal, breast of the emerald-crested manakin; vegetable, grape, hyacinth, gentian; mineral, blue copper ore.

29. Ultramarine blue (equal parts of Berlin and azure blue). Animal, upper side of the wings of small blue heath butterfly; vegetable, borage; mineral, azure stone or lapis lazuli.

30. Flax-flower blue (Berlin blue, with a slight tinge of ultramarine blue). Animal, light parts of the margin of the wings of devil's butterfly; vegetable, flax flower; mineral, blue copper ore.

31. Berlin blue (the pure or characteristic colour of Werner). Animal, wing feathers of the jay; vegetable, hepatica; mineral, blue sapphire.

32. Verditer blue (Berlin blue, with a small portion of verdigris green). . . . Mineral, lenticular ore.

33. Greenish blue, the sky blue of Werner (Berlin blue, white, and a little emerald green). . . . Vegetable, great fennel flower; mineral, turquoise, some fluor spar.

34. Greenish blue, the small blue of Werner (Berlin blue with white, a small quantity of grey, and a hardly perceptible portion of red). Animal, back of blue titmouse; vegetable, small fennel flower; mineral, iron earth.

V. PURPLES.

35. Bluish lilac purple (bluish purple and white). Vegetable, blue lilac; mineral, lepidolite.

36. Bluish purple (equal parts of Berlin blue and carmine red). Animal, azure blue butterfly; vegetable, parts of white and purple crocus. . . .

37. Violet purple, violet blue of Werner (Berlin blue, mixed with red and a little brown). . . . Vegetable, purple aster; mineral, amethyst.

38. Pansy purple (indigo blue, with carmine red and a slight tinge of raven black). Animal, chrysomela Goettingensis; vegetable, sweet-scented violet; mineral, Derbyshire spar.

39. Campanula purple, the characteristic colour (equal parts of ultramarine blue and carmine red). . . . Vegetable, Canterbury bell, campanula persicifolia; mineral, fluor spar.

40. Imperial purple (azure and indigo blue, with carmine red, about equal parts of each). . . . Vegetable, deep parts of flower of saffron crocus; mineral, fluor spar.

41. Auricula purple (plum purple, with indigo blue and much carmine red). Animal, egg of largest bluebottle or flesh fly; vegetable, largest auricula; mineral, fluor spar.

42. Plum purple, the plum blue of Werner (Berlin blue, with much carmine red, a very little brown, and an almost imperceptible portion of black). . . . Vegetable, plum; mineral, fluor spar.

43. Red lilac purple (campanula purple, with a considerable portion of snow white, and a very little carmine red). Animal, light spots of the upper wings of the peacock butterfly; vegetable, red lilac, pale purple primrose; mineral, lepidolite.

44. Lavender purple, the lavender blue of Werner (blue red, and a little brown and grey). Animal, light parts of the spots on the under wings of the peacock butterfly; vegetable, dried lavender flowers; mineral, porcelain jasper.

45. Pale blackish purple (lavender purple, mixed with a little red and black). . . . mineral, porcelain jasper.

VI. GREENS.

46. Celandine green (verdigris green and ash grey). Animal, *phalæna margaritaria*; vegetable, back of *tussilago* leaves; mineral, beryl.

47. Mountain green (emerald green, with much blue and a little yellowish grey). Animal, *phalæna viridaria*; vegetable, thick-leaved cudweed, silver-leaved almond, actynolite beryl.

48. Leek green (emerald green, with a little brown and bluish grey). . . . Vegetable, sea-kale, leaves of leeks in winter; mineral, actynolite.

49. Blackish green (grass green, with a considerable portion of black). Animal, many small insects; vegetable, dark streaks on the leaves of Cayenne pepper; mineral, serpentine.

50. Verdigris green (emerald green, much Berlin blue, and a little white). Animal, tail of the small long-tailed green parrot . . . mineral, copper green.

51. Bluish green (Berlin blue, and a little lemon yellow and greyish white). Animal, egg of the thrush; vegetable, under disc of wild rose leaves; mineral, beryl.

52. Apple green (emerald green, mixed with a little greyish white). Animal, under side of the wings of the green-broom moth.

53. Emerald green, the characteristic colour of the greens (equal parts of Berlin blue and gamboge yellow). Animal, beauty spot on the wing of seal-drake . . . mineral, emerald.

54. Grass green (emerald green, mixed with a little lemon yellow). Animal, *scarabeus nobilis*; vegetable, general appearance of grass fields, sweet sugar pear; mineral, ural, mica.

55. Duck green (emerald green, with a little indigo blue, much gamboge yellow, and a very little carmine red). Animal, neck of mallard; vegetable, upper disc of yew leaves; mineral, ceylanite.

56. Sap green (emerald green with much saffron yellow, and a little chestnut brown). Animal, under side of lower wings of orange-tip butterfly; vegetable, upper disc of leaves of the woody nightshade.

57. Pistachio green (emerald green, mixed with a little lemon yellow, and a small quantity of brown). Animal, neck of the eider drake; vegetable, ripe pound pear; mineral, chrysolite.

58. Asparagus green (pistachio green, mixed with much greyish white). Animal, brimstone butterfly; vegetable, variegated horse olive geranium; mineral, beryl.

59. Olive green (grass green, mixed with much brown). . . . Vegetable, foliage of the *lignum vitæ*; mineral, epidote olivine ore.

60. Oil green (emerald green, mixed with lemon yellow, chestnut brown, and yellowish grey). Animal, animal and shell of common water snail; vegetable, nonpareil apple from the wall; mineral, beryl.

61. Siskin green (emerald green, mixed with much lemon yellow, and a little yellowish white). Animal, siskin; vegetable, ripe Colmar pear, Irish pitcher apple; mineral, mica, from the ural.

VII. YELLOWS.

62. Sulphur yellow (lemon yellow, mixed with emerald green and white). Animal, yellow parts of large dragon fly; vegetable, various coloured snap-dragon; mineral, sulphur.

63. Primrose yellow (gamboge yellow, mixed with a little sulphur yellow, and much snow white). Animal, pale canary bird; vegetable, wild primrose; mineral, pale coloured sulphur.

64. Wax yellow (lemon yellow, reddish brown, and a little ash grey). Animal, larva of large water beetles; vegetable, greenish part of nonpareil apple; mineral, semi-opal.

65. Lemon yellow, characteristic colour of the yellow series of Werner (a mixture of gamboge yellow, and a little ash grey). Animal, large wasp or hornet; vegetable, shrubby goldylocks, fresh lemon peel; mineral, yellow orpiment.

66. Gamboge yellow, characteristic colour of thyme. Ani-

mal, wings of goldfinch, canary bird; vegetable, yellow jasmine; mineral, high coloured sulphur.

67. King's yellow (gamboge yellow, with a small portion of saffron yellow). Animal, head of the golden pheasant; vegetable, yellow tulip, cinque foil. . . .

68. Saffron yellow (gamboge yellow, with gall-stone yellow, about equal parts of each). Animal, tail coverts of the golden pheasant; vegetable, anthers of saffron crocus.

69. Gall stone yellow (gamboge yellow, with a small quantity of Dutch orange, and a minute proportion of honey yellow). Animal, gall stones; vegetable, marigold apple.

70. Honey yellow (sulphur yellow, mixed with chesnut brown). Animal, lower parts of the neck of the bird of Paradise; . . . mineral, fluor spar.

71. Straw yellow (sulphur yellow, with much greyish white, and a little ochre yellow). Animal, some Canary birds; vegetable, oat straw; mineral, calamine.

72. Wine yellow (sulphur yellow, mixed with reddish brown and grey, with much more white). Animal, body of silk moth; vegetable, white currants; mineral, Saxon topaz.

73. Sienna yellow (primrose yellow, with a little ochre yellow). Animal, vent parts of the tail of bird of Paradise; vegetable, stamina of honeysuckle; mineral, pale Brazilian topaz.

74. Ochre yellow (sienna yellow, with a little light chesnut brown). Animal, vent colours of the redstart; . . . mineral, porcelain jasper.

75. Cream yellow (ochre yellow, mixed with a little white, and a very small quantity of Dutch orange). Animal, breast of teal drake; . . . mineral, porcelain jasper.

VIII. ORANGE.

76. Dutch orange (the orange yellow of Werner is gamboge yellow, with carmine red). Animal, crest of golden crested wren; vegetable, common marigold; mineral, streak of red orpiment.

77. Buff orange (sienna yellow, with a little Dutch orange). Animal, streak from the eye of the king-fisher; vegetable, stamina of large white cistus; mineral, natrolite.

78. Orpiment orange, the characteristic colour (about equal parts of gamboge yellow, and arterial blood-red). Animal, the neck ruff of the golden pheasant, belly of the water newt; vegetable, Indian cress.

79. Brownish orange (orpiment orange, with a little hyacinth red, and a small quantity of light chesnut brown). Animal, eyes of the largest flesh fly; vegetable, style of the orange lily; mineral, dark Brazilian topaz.

80. Reddish orange (buff orange, mixed with a considerable portion of tile red). Animal, lower wings of the tiger moth; vegetable, hemimeris, buff hibiscus. . . .

81. Deep reddish orange (Dutch orange, mixed with much scarlet red). Animal, gold fish, lustre abstracted; vegetable, scarlet Lymington apple. . . .

IX. RED.

82. Tile red (hyacinth red, mixed with much greyish white, and a small portion of scarlet red). Animal, breast of the cock bullfinch; vegetable, shrubby pimpernel; mineral, porcelain jasper.

83. Hyacinth red (scarlet red with lemon yellow and a minute proportion of brown). Animal, red spots of the *lygæus apterous* fly; vegetable, red on the golden rennet apple; mineral, hyacinth.

84. Scarlet red (arterial blood red with a little gamboge yellow). Animal, scarlet ibis or curlew, mark on head of red grouse; vegetable, large red oriental poppy; mineral, light red cinnabar.

85. Vermillion red (scarlet red with a minute portion of brownish red). Animal, red coral insect; vegetable, love apple; mineral, cinnabar.

86. Aurora red (tile red with a little arterial blood-red and a slight tinge of carmine red). Animal, vent coverts of

pieced woodpecker; vegetable, red on the naked apple; mineral, red orpiment.

87. Arterial blood red; the characteristic colour of the red series. Animal, head of the cock goldfinch; vegetable, corn poppy, and cherry . . .

88. Flesh red (rose red mixed with tile red and a little white). Animal, human skin; vegetable, larkspur; mineral, heavy spar, limestone.

89. Rose red (carmine red with a great quantity of snow white and a very small portion of cochineal red) . . . Vegetable, common garden rose; mineral, figure stone.

90. Peach blossom red (lake red mixed with much white) . . . Vegetable, peach blossom; mineral, red cobalt ore.

91. Carmine red, the characteristic colour of Werner (lake red with a little arterial blood red). . . . Vegetable, raspberry, carnation, pink; mineral, oriental ruby.

92. Lake red, the crimson red of Werner (arterial blood red with a portion of Berlin blue). . . . Vegetable, red tulip, rose officinalis; mineral, spinel.

93. Crimson red (carmine red with a little indigo blue). . . . Mineral, precious garnet.

94. Purplish red, the columbine red of Werner (carmine red with a little Berlin blue and a small portion of Indigo blue). Animal, outside quills of terico; vegetable, dark crimson officinal garden rose; mineral, precious garnet.

95. Cochineal red (lake red mixed with bluish grey) . . . Vegetable, under disc of the decayed leaves of none-so-pretty; mineral, dark cinnabar.

96. Venous blood red (carmine red mixed with brownish black). Animal, venous blood; vegetable, musk flower of dark purple scabious.

97. Brownish purple red, the cherry red of Werner (lake red mixed with brownish black and a small portion of grey). . . . Vegetable, flower of deadly night-shade; mineral, red antimony ore.

98. Chocolate red (venous blood red mixed with a little brownish red). Animal, breast of bird of Paradise; vegetable, brown disc of common marigold.

99. Brownish red (chocolate red mixed with hyacinth red and a little chestnut brown). Animal, mark on throat of red throated diver . . . mineral, iron flint.

X. BROWNS.

100. Deep orange-coloured brown (chestnut brown with a little reddish brown and a small quantity of orange brown). Animal, head of pochard; vegetable, female spike of cat's-tail reed . . .

101. Deep reddish brown (chestnut brown with a little chocolate red). Animal, breast of pochard, neck of teal-drake; vegetable, dead leaves of green panic grass; mineral, brown blende.

102. Umber brown (chestnut brown with a little blackish brown). Animal, moor buzzard; vegetable, disc of rudbeckia . . .

103. Chestnut brown, the characteristic colour of the browns of Werner's series (deep reddish brown and yellowish brown). Animal, neck and breast of red grouse; vegetable, chestnut; mineral, Egyptian jasper.

104. Yellowish brown (chestnut brown mixed with a considerable portion of lemon yellow). Animal, light brown spots on the guinea-pig, breast of hoopoe . . . mineral, iron flint and common jasper.

105. Wood brown (yellowish brown mixed with ash grey). Animal, the common weasel, light part of feathers on back of snipe; vegetable, hazel nuts; mineral, mountain wood.

106. Liver brown (chestnut brown with a little black and olive green). Middle parts of feathers of hen pheasant and wing coverts of grosbeak. . . . Mineral, semi-opal.

107. Hair brown (clove brown mixed with ash grey). Animal, head of pin-tail duck.

108. Broccoli brown (clove brown mixed with ash grey and a small tinge of red). Animal, head of black-headed gull . . . mineral, zircon.

109. Clove brown (ash grey mixed with a little blue red and chestnut brown). Animal, head and neck of male kestrel; vegetable, stems of black currant bush; mineral, surface of rock crystal.

110. Blackish brown (composed of chestnut brown and black). Animal, stormy petrel, wing coverts of blackcock, forehead of fowmart . . . mineral, mineral pitch from Neufchatel, moor coal and bituminous wood.

The colours which may be thus recognised in the animal, vegetable, and mineral kingdoms, are liable to undergo many changes which appear determined by the influence of light, heat, change of seasons, climate, age, food, soil, and certain chemical actions to which all inert matter is constantly liable. It appears to be a provisional law that animals, subjected to be preyed upon by other animals, assume the colour of the soil or medium by which they are surrounded. Thus rabbits appear of the colour of the soil in which they burrow, and the colours of the scales of fish vary according to the colour of the river beds over which they swim. It has been shown by an intelligent naturalist that when perch, gudgeon, or minnows, are confined in water, the bottom of which rests upon different coloured soils, the scales of the fish gradually change their colour, and assimilate to that of the soil (Stark, in Jamieson's Journal, vol. ix. p. 329, 1830). A still more remarkable exemplification of this provisional law may be observed in the colour of the eggs of birds. Those birds whose nests and eggs are more exposed to the view of their enemies than other animals, lay eggs which are of the colour of the objects by which they are surrounded; thus the partridge, pheasant, and other birds which lay their eggs among grass without any regular nest, present us with eggs of a greenish colour, so that they escape the detection of rapacious birds; while those which nestle in holes, as the woodpeckers' wrynecks, water ousels, and swifts, present us with eggs of a pure white, which, if exposed, would be immedi-

ately perceived by their enemies (Ibid, vol. viii. p. 130, 1829). The most curious fact, however, which the naturalist observes is the change of colour which plants and animals, under various circumstances, undergo. These too are often of singular contrast; thus the flower of the blue crocus frequently changes into yellow, the blue columbine to red, the blue violet to white. The changes too during inflorescence are often very remarkable; thus the flower-buds of the scorpion grass (*Myosotis palustris*) are delicate rose colour, but they turn to a bright blue as they open. It is well known that the plumage of birds, and the hair of quadrupeds, are subject to remarkable changes of colour, determined obviously by the influence of season, climate, age, food, and other incidental circumstances. As winter approaches, the ptarmigan begins to change colour, and gradually, about the month of February, becomes perfectly white. As the summer, however, returns, black spots appear upon the feathers, which gradually expand into a reddish brown until, in summer, the bird resumes its mottled brownish colour. The change of the human hair from a dark colour to grey or white is a matter of daily observation, and known to be caused by grief, and also by old age. The hair of the unfortunate Louis XVI. of France became quite grey during the night previous to his execution; so also, on the authority of Madame de Campan, did that of the unfortunate Marie Antoinette the night previous to her unhappy death. And to what are these changes of colour referrible? the explanation will depend entirely on the theory of

colour adopted. If we accept the Newtonian or molecular theory, we must conclude that some change takes place in the size of the particles of the bodies, whether hair, feathers, or flower petals, which causes an alteration in the absorption and transmission of the primary rays; thus in the case of the autumnal leaf, when no longer nourished by the usual circulation of the sap, its particles undergo a change which cause it to absorb the green rays which were before reflected, and reflect the red, orange, or red rays which were before absorbed. To this theory, however, Sir David Brewster does not assent; he considers it probable that these tints are caused by two different juices on each side the plant, which exert a different affinity over the primary rays. "The colours of vegetable life," he observes, "and those of various kinds of solids, arise, we are persuaded, from a specific attraction which the particles of these bodies exercise over the different coloured rays of light." As autumn therefore advances, we are to presume that the juices of the leaf change; there is a difference in the secretion, and consequently in the attraction of the primary rays. It must, however, be confessed that this is a mere hypothesis, it is overturning one theory by another equally undemonstrable, for where is the proof that any such affinity exists as is here supposed? Lastly, if we adopt the undulatory theory, we must conclude that the change of seasons, age, climate, &c. causes such a change in the particles of bodies as induces a greater or lesser frequency in the undulations of the etherial medium, now producing the violet and now the crimson colour.

However veiled in obscurity may be the laws of light and colour, the different colours which irradiate the world, are of eminent importance in the general economy of nature. The colour of different soils influences their fertility, the darker soils absorb, and the light reflect the solar rays. The varied shades of green presented by grass, herbs, and the foliage of trees, relieves the surface of the earth from a monotony which otherwise would have been painful to the eye. The gaudy plumage of birds in tropical climates protects them from the direct heat of the sun's rays, which are reflected from their feathers in brilliant rainbow hues. Animals, which are guided principally by the sense of sight, are attracted to their prey by the colour which now exposes and now conceals them from their view. The vulture perceives chiefly by its colour its prey at an almost incredible distance; and whales are attracted by their colour to the molluscæ on which they feed. The disposition, therefore, of the colours of natural bodies is in strict unison with that harmony of design which is manifested throughout the universe, and which reveals itself, especially to the naturalist, in every path he is tempted to explore.

COLTS'-FOOT is the *Tussilago farfara* of Linæus. It is a medicinal herb, and a very troublesome weed to the farmer of damp clayey land. The flowers come forth early in the year, and long before the large roundish leaves. Deep and repeated ploughings in the spring months is the only method of destroying the roots and preventing it spreading.

COLUBER, a genus of ophidian reptiles, belonging to the division of true serpents which are not venomous; and exceeding in number any other genus of the order, and, indeed, every genus of reptiles. They are of course without fangs or moveable teeth adapted for inserting poison into wounds; and, therefore, they are either simply swallowing serpents, or

crushing serpents, according to their size and strength. They have large plates on the belly, and a double row of plates on the under side of the tail, by which they are readily distinguished from the poisonous serpents; but the number of species in the genus itself is so great, and the distinctions between some of them are so slight, that they can hardly be brought into any intelligible order without a degree of minuteness of detail, which is quite incompatible with the nature of a popular work; and which, though it could be accomplished, would be of little value to any but those who make this very difficult class of animals a particular study.

In disposition and habits they all very nearly resemble each other; but they differ greatly in size, in strength, and consequently in the sort of prey on which they live. Their head is generally flattened, of an elongated oval form, having the muzzle blunt and beset with a few tubercles; the head is covered with large plates, about nine in number. Their tongue is forked, and they move it with great celerity; and from this probably has arisen the vulgar notion of the tongues of serpents being darts with which they can inflict envenomed wounds; which notion, though it has found its way pretty largely into figurative writing, is of course wholly without foundation. The lips of these serpents are usually covered with scales rather larger than those on the body. The teeth in the jaws are numerous, and generally much hooked, and they assist in the process of swallowing. In some of the smaller species the skin is very tender, but in the larger ones it is correspondingly strong. That of the head and throat, in particular, admits of great extension; but when the scales are removed, and it is tanned into leather, it is compact and thick, and very durable. The scales upon them all are imbricated, and generally speaking they are lozenge-shaped, and the marks of them give a very peculiar appearance to the tanned skin.

The whole of the genus are oviparous, and most of them deposit their eggs in the ground to be hatched by the heat of the sun. Those eggs are elongated ovals, with the ends of equal thickness, and covered with a whitish membrane about the consistency of parchment, which is flexible at first, but which hardens by exposure to the air. The young, while in the egg, floats in an albuminous fluid, something similar to that which surrounds a chick in the egg; and it is furnished with a true umbilical cord, which is attached to the belly a little in advance of the vent. All the species of this genus are understood to change their skins as is the general habit of serpents.

Both from their form, and the power and voracity of some of the larger species, these animals lie under the general denunciation which the civilised world appears to have pronounced upon the whole serpent tribe. Whether this arises from the metaphorical allusion to the serpent, as the symbol of temptation in the book of Genesis, it is of little consequence to inquire; neither is it worth while to go into a formal refutation of the vulgar notion that serpents walked on feet, before the catastrophe above alluded to; and that, in consequence of their deceitful conduct, they were subsequently doomed to crawl on their belly. We may just remark that a serpent is no more a mutilated creature than any other member of the animal kingdom; and that, all footless as they are, their powers of locomotion are, especially in many members of this genus, very efficient and also very

graceful. If we were to take the degradation of the serpent, in point of shape, in a literal sense, we would also require to take its feeding in the same. Now, the metaphorical denunciation against the serpent is, that it shall "eat dust" as well as crawl on its belly; and we know from observation, that there is no serpent whatever which subsists upon this species of aliment. By far the greater majority of serpents prey upon live animals of some description or other; and the part which they thus perform in wild nature is a very important one, especially in warm regions, where the production of small life is so abundant and so rapid, that, were it not for some such a race of beings as the serpents, the system of nature could hardly be carried on.

It may not be amiss, as tending in part to remove the obloquy under which this order of animals lies, and the horror which the vulgar have in general of them, to mention very shortly the meaning of the word "serpent" in the passage above alluded to. It means "self conceit," or a following of one's own appetites not only without any regard to right and wrong, but with a knowledge that the gratification of the appetite is not right; and the denunciation is directed not against any species of ophidian reptile, but against this figurative serpent—the corruption of the human heart, or the perverseness of human actions. "Upon thy belly shalt thou go," is the declaration of what we perceive every day to be true; namely, that they who once break through the laws of justness and propriety in the gratification of their bodily appetites, lose their intellectual character, and become the slaves of their own animal propensities, for the whole of which the belly is often used as a figurative and certainly a very appropriate expression. So also the eating of dust means nothing more than that those who thus degrade their intellectual nature, and become mere animals in habit, can have no possession, and no feeling of the value of any possession, except what is connected with gross material indulgences, the figurative name for which, is very often the dust of the ground; and this dust, in the sense in which it is thus used, is a very appropriate name—it means vegetable mould, or that species of earth which is most favourable to the growth of plants; and we need not add that this mould is the primary element in the support both of animals and of vegetables, the only substances which can gratify the appetites of man.

These remarks are not foreign to the subject in hand, because the genus coluber contains those serpents which are more generally distributed over the world, most numerous, most beautiful in their colours, and most disposed to remain near the habitations of man, and we may almost say absolutely court human society. Though they belong to different classes of animals, differ much in their forms, in their mode of production, and in their way of life, yet, if we take those differences along with us, we shall find that there is a considerable analogy between those serpents and the cats. They inhabit different kinds of places no doubt; and, generally speaking, they are better swimmers, and much more aquatic in their habits than the feline race, but they resemble these in the facility with which they glide through tangled places, and the certainty with which they capture small quadrupeds, birds, and other little animals, especially different kinds of mollusca, which would not leave a single green leaf in the more humid brakes of the warm latitudes, if it were not for the labours of these ser-

pents. Those places are very generally so close and tangled, that nothing but a serpent can penetrate them; and thus, though there are many large birds which ply diligently as scavengers in the tropical countries, they can only prey in places which are comparatively open; and thus, though they might and do pick up the dead bodies of those small animals, which are subject to casualties during the violence of the season, and also catch a good number of strays, they leave what may be considered as the nurseries of small animals wholly untouched; and thus the serpents become the true regulators of their numbers.

When we compare the species of this genus with each other, and take along with them the boas, which though they have distinctive characters in the systems of natural history yet very much resemble the colubers in their habits, we find that though there is not, strictly speaking, a polar race, as there is in the cat tribe, yet there is, as in these, an increase, both in numbers and in size and strength, as we approach those regions of the world where the action of life, both animal and vegetable, is at a maximum.

A very little reflection will suffice to convince the reader that there can be no species of serpent well adapted for inhabiting the land in the extremes of the polar countries. Serpents are covered with scales, which, even admitting that they are composed of the same materials as fur or feathers, are, from the very fact of their being in solid plates, while the others are loose and flocculent, much better conductors of heat. The consequence is, that serpents are capable of enduring only a limited range of temperature, in which respect they bear no inconsiderable resemblance to scaly fishes, and no attempted domestication would probably succeed in enabling a serpent to accommodate itself to difference of climates, or of seasons, to any extent at all comparable with that of which furred and feathered animals are capable; neither would it, perhaps, be possible to preserve them in a state of activity during those seasons of the year at which they are naturally dormant. We shall, however, be better able to notice those physiological characters of serpents which adapt them to different latitudes, and to peculiar localities, when we have the whole class before us in the general article OPHIDIA; therefore we shall only farther remark that in the north-west of Europe, the species of coluber are very rare, that they increase as we proceed southward and eastward, and probably extend farther into Siberia than they do into corresponding climates into western Europe. In those northerly places, however, the individuals are of small size; but in the Oriental Archipelago, they rival if they do not exceed the Boas of the American continent; and, though many of the stories told of them must be considered as exaggerated, yet it is certain that in Java, and the adjacent islands, they are very formidable animals capable of crushing deer and goats to death in their folds, and of swallowing an animal several times the diameter of their own body.

All the members of the genus are, indeed, remarkable for their capacity in swallowing. Their jaws, of which nearly a corresponding description will be found in the article BOA, are capable not only of opening till the whole gape is a plane, but of considerably more distension both ways, by means of the elastic cartilage which unites the different bones of the jaws. The smaller species subsist upon frogs, small lizards, mollusca, mice, and other little animals. And in

situations where they abound, and are not destroyed in consequence of the superstitious prejudice there is against them, they are useful in clearing the vicinities of houses of many troublesome creatures. They are also generally expert in climbing trees, and almost all of them are excellent swimmers. They are not absolutely aquatic, but they prefer moist situations; and the very large ones are seldom found at a great distance from the water.

There are some idle stories believed by the country people of those places where serpents of this genus are common, such as that they suck the milk of cows, whose mammae they reach by twining up their hind legs, and that by holding on with their teeth while they suck, they occasion disagreeable wounds. It does not, however, appear that there is any truth in these stories, any more than there is in the other allegations, that they are apt to creep into the mouths of persons who sleep in the open air near their haunts, and if they do not choke them by sticking in the throat, prove very disagreeable inmates of the stomach. This prejudice is a very old one, and we find it continued to the present day; and it has not always been confined to the mere vulgar, but was eagerly laid hold of by empirical practitioners in pretended medicine, during those periods of the history of that most extraordinary art, when it was not deemed necessary that the doings of the doctor should have any connexion whatever with physiology or with common sense, but that he had the better chance of success the more he was opposed to both.

That these animals are fond of creeping into holes is certainly true; but the mouth of a warm-blooded living animal is not the most likely lodging-place for them; first, because the temperature would be too high for them; and, secondly, because the gullet of an animal is the gate of death to everything which enters; and if it were possible to imagine that a savage could once get a tiger or a boa constrictor fairly down his throat, indigestion apart, he would feel no more trouble from it than from any dead substance. There neither is nor can be any living creature in the stomach of an animal, but such as can naturally breed there; and of parasitical animals (*Entozoa*) which are found in the alimentary vessels of other animals, the majority, if not the whole are found in the intestinal canal farther down than the true digestive stomach.

In temperate countries none of the colubers attain a very large size; but they are often very beautiful in their colours, and very lively and graceful in their motions. The sound of all their voices is a sort of hiss, sometimes very sharp, but varying considerably in tone in the different species. When the weather begins to get cold, they retire to their holes, where they remain dormant till the spring; and they are not much seen abroad even in the warmer months. In the warmer part of the season, indeed, they seem to require a good deal of exposure to the sun before they recover from their torpor; for then they are abroad and active in proportion as the weather is hot and sunny; but it should seem that, beyond a certain degree, the heat of the sun is not so favourable to them. This must, however, in no small degree, depend upon the nature of the climate, and the consequent adaptation of the species.

The number of species, and even of sub-genera, into which these reptiles have been divided, are so many, and have been so differently arranged by different authors, that the details of them would convey

no popular information. The simplest view that can be given of them is a division into four sub-genera: *Python*, *Hurria*, *Dipsas* and *Coluber*, properly so called, and it is the last of the sub-genera of which the species are so numerous, and many of which are natives of temperate climates.

PYTHON. This sub-genus very closely resembles the boa, except that the plates on the under-side of the tail are double, whereas those in the true boas are single. The largest species of this genus is the great coluber of the Sunda Isles (*Coluber Javanicus*), which is called "*Ular sawa*, or the water serpent," by the Malays. It does not appear, however, to be exclusively an inhabitant of the waters, though it is generally found near the rivers, or in marshy or humid places. It is a large species, sometimes attaining the length of thirty feet; it kills its prey by crushing, and is the boa constrictor of the eastern world. There are one or two other species of this sub-genus, named by systematic writers, and both described as being much smaller than this one; but it does not appear that, unless in so far as size and strength are concerned, they differ much in their manners; and, from the long life, slow growth, and annual change of skin, and many other circumstances, together with our general ignorance of the habits of the more powerful serpents, it is no very easy matter to say what is a species, and what is not.

HURRIA. This sub-genus is altogether doubtful, being probably founded upon an imperfectly formed species of the other; and its specific distinction, which is that of having the scales at the root of the tail single as in the boas, but those toward the point double as in the colubers, is not of much importance.

DIPSAS. This name, which is given to an Indian serpent, which is black marked with white rings, is not a very happy one, in as much as dipsas was the Greek name for a fabulous serpent (or one that we may presume to have been fabulous), the bite of which occasioned death by thirst in the person bitten. This species, which is quite harmless, has been confounded with a species of viper of the same country, which is poisonous. The body of this serpent is compressed, not so thick as the head; and the scales along the back are larger than those on the sides, and form a sort of elevated crest.

COLUBER. Of this sub-genus there are about 147 species mentioned by the systematic writers on *Ophiology* (or the natural history of serpents considered as a class), and many more are named and probably exist, at the same time it is not impossible that two or three names may, owing to accidental differences of appearance, have been given to the same species. The history of so many species, none of which differ very much in their manners, could hardly be treated in a popular manner, even if the particulars were all well known. But that is far from being the case; so that we must content ourselves with brief notices of a few, both of the European species and of those which are met with in other parts of the world.

Common Snake (*Coluber natrix*, *Natrix torquata*), this is the most generally distributed, and on that account the best known, of all the European species.—It is also the only one, or at least the principal one, which is found in Britain, not unfrequently in England, but much more rarely in Scotland. It grows to the length of three or four feet: its back is of a dusky-brown colour, with two stripes formed of a succession of black spots, running the whole of its length; and

these are crossed by irregular spots of the same colour which are very numerous. The belly is dusky with a tinge of blue; and there is a spot of yellow, with a three-cornered one on each side of the neck. These last-mentioned spots compose the collar, from which the species gets the name of *torquata*, or ringed. The head is flattened, and the muzzle rounded; and the head has four rows of large scales, two in the first row, two in the second, three in the third, and four in the fourth. There are seventeen scales in each jaw: the scales on the sides are very small and smooth, without any keel or projection in the middle. There are about 120 plates on the belly, and from fifty to sixty pairs on the under part of the tail. The eggs, which are about eighteen or twenty in number, are deposited in dunghills, hotbeds, and other places where they have the advantage of heat from the fermentation of vegetable or animal matter.

This species is chiefly found in humid places, near the margins of waters, and it takes readily to the water, and is rather an expert swimmer. Its food consists of mice, frogs, insects, and molluscous animals. It is a harmless and even gentle creature, and capable of being tamed, in which state it shows not a little attachment and affection; and gives evidence that it was intended for some useful domestic purpose, for it is a law, and a very beautiful one, in the animal kingdom, that every animal, of whatever race it may be, and whether an inhabitant of the land or the water, which courts the society of man, or even shows no positive reluctance and desire to escape, is in some way or other useful to man, or might be rendered so, if man would study its nature, and attend to the functions which it is capable of performing. But the harmless nature, and the gentle manners, and even the usefulness of this animal, have not been sufficient to protect it from a full share of that very unfounded prejudice which people generally have against the whole of the race. Even the Bard of Avon, who is, generally speaking, as superior as a naturalist as he is as a poet, has helped to perpetuate the animosity with which this gentle creature is attacked. This is the "water" or "fen" snake, which formed one of the ingredients of the "cauldron of diablerie," prepared by the witches, in order to shake the soul of the stern Macbeth, and torment him before his time:

Fillet of a fenny snake.
In the cauldron boil and bake.

This species of serpent is delicate in its nature, and not found in the colder or more elevated parts of the country. In Scotland, it is very rare, and confined to some of the warmer districts of the south; and although there is a Scotch name for it, there is not a Gaelic one, so that it never can have been common, or even known in the Highlands of Scotland, where there is a name for the poisonous viper. But although it has not been found in the eastern parts of the Highlands, there is some reason to believe that it is by no means rare in Argyleshire, and in some of the more southerly of the Hebrides, where the climate is mild and humid. It is also said to be rather common in many parts of Ayrshire, near the coast, especially about the hills of Dundonald. But as, in Scotland especially, where snakes of any kind are of rare occurrence, and in many places of which, the people will not eat eels because of their snake-like form, every one that can be discovered is instantly killed, and killed with the stigma attached to it that it is a poisonous

viper, or adder, as it is called in that part of the island.

One specimen, differing in its characters from the common species, is mentioned as having been discovered in the south of Scotland, near Dumfries, the plates on the belly of which are stated at 162, and those on the tail eighty. The colours were at the same time paler than those of the common snake, and the dorsal scales without any mesial crest as they have in that species. But the specimen was a very small one, not above five inches in length, and no mention is made of any other instance of its occurrence within the island; so that it is impossible to form any positive conclusion respecting it. The history of British reptiles is a subject which stands in need of far more extensive and more careful investigation than it has hitherto met with; but from the peculiar haunts, the retiring habits, and the long hybernations of most of these animals, the study of them is attended with peculiar difficulties.

Coluber coronella. This species is not uncommon in the northern parts of France, and seems to resemble the Dumfries-shire specimen rather more than the Austrian snake does, with which Dr. Fleming, in his account of British animals seems disposed to class it. This one is represented as being of small size, and with all its scales perfectly smooth; the upper part of the body bluish, with two rows of lenticular black spots; the flanks are of a paler reddish colour, clouded in some places with darker; and there are two triangular spots of yellow at the back of the head, which is of an oval form, and covered with very large scales for the size of the animal.

Coluber viridiflavus. The green and yellow snake is a very beautiful species, very abundant in the south of France, and especially in the country around Bordeaux. The size varies from two to five feet in length; its head is large, its under part is of a delicate lemon yellow, and the scales on the upper part are alternately intense black and very brilliant green, variously marked in different specimens, but always very rich and beautiful. The tail is longitudinally marked with black and yellow. This species is very expert in climbing trees, and in capturing small birds, and plundering their nests; it is a very delicate creature, and killed by the slightest blow on the back.

Coluber Austriaca. Though this species was first discovered in Austria, and named after that country, it is, perhaps, more abundant in the south of France, in Spain, and in some parts of Italy, than it is any where to the northward of the Alps. The upper part has the ground colour of a reddish grey, marked with five small lines behind the eyes, a bar across the back of the head, and two rows of alternating spots along the back, which are brown and blackish. The lower part is iron grey, clouded with darker. Its scales are entirely smooth, and the upper part has a shining lustre. It is but a small species.

Coluber viperinus. This species is found in the south of France, in Spain, and in Italy. It is of a brownish-grey colour above, marked with a zig-zag line of spots down the back, which are yellow in the centre, and black at the extremities; there is also a row of very small spots along each side. The under part is mottled with black and grey.

Coluber tetragonus. This species, as its name indicates, has the section of the body of a quadrangular form. It is small, rarely attaining a foot in length, and is not so common as many of the other

species, though it is met with in some parts of France. It is a shining serpent, with smooth scales, greenish grey on the upper part, with a row of black dots along the dorsal line, and two parallel ones on the sides. The lower part is yellowish.

Coluber quadrilineatus, the four-striped snake. The *Coluber elaphis* of Shaw is the largest of all the European serpents, and is generally understood to be the boa of the ancients. It is yellow on the upper part, marked with four longitudinal lines of brown, or black, and this part of the body has a soft velvety appearance; the under part is black, and glistens with a lustre resembling polished steel. The scales on the back are carinated, but those on the flanks are smooth.

Coluber flavescens. This is the Esculapian serpent, *Coluber Esculapii* of Shaw, but not the Esculapian serpent of Linnæus. The species to which he gave that name is a native of America, and of course could not by any possibility be known to the ancient Greeks. This species is very common in Greece, in Italy, and not rare in some parts of France. It is thicker in proportion to its length than any of the European species, and its hiss is much stronger and louder. It is an active animal, and preys equally on the land and in the water, gorging itself while successful, until it is unable to move. Jacquin mentions one that was killed while in the state of semi-dormance, in the stomach of which there were five small birds, a common lizard, and a mullet, which, substituting turtle for lizard, formed three courses worthy of an alderman; and in procuring which we must naturally suppose that this rapacious serpent had laid the air, the earth, and the waters, under contribution within a very short space of time. The colour of the upper part is of an earthen grey, with a longitudinal band of a darker shade on each side; the scales nearest the abdominal plates are white, with black borders on their under edges. The belly is whitish mottled with grey.

Coluber meridionalis. This species is found in Provence and the adjoining parts of the South of France. The ground colour above is greyish, with large ash coloured spots on the top of the head behind the eyes, and with four lines of smaller ones along the sides. The spots on the back run into each other two and two; but those on the sides are all separate. The extremity of the transverse plates is black, the middle white, marked with black spots. This is a very small species, and not so common as some of the others.

Coluber Girondicus is greyish, with smooth scales, the sides of which form brown bars across; the belly is damasked with yellow and black; the head is compressed, and there is a cross mark on the top of the head. This species has been observed on the banks of the Gironde, where it attains rather more than two feet in length.

Coluber sanguinolenta. This species has also been observed on the banks of the Gironde. It bears some resemblance to the Esculapian serpent, but it is smaller, and its colours are differently marked. It is brownish ash, mottled with round spots of reddish brown with black centres, which give it the appearance of being spotted all over with blood, hence its specific name. Its scales are carinated, and its head is large and broad.

The preceding list is considerable, and yet we have no reason to suppose that it includes more than a

fraction of even the European species, of this very extensive genus. In various places of the South, and even in the central parts of the country, colubers are mentioned, differing much both in their forms and their markings, from any of those which we have noticed; but the accounts of them are very vague; and so little is known of the habits of the animals, and the changes of appearance, from age, season, and sex, to which they are subject, and also of the varieties, climatal or otherwise, into which they are apt to run, that we must speak of them with great caution and shall only farther observe of this genus, as European, that it offers a very wide, and far from an uninteresting field of inquiry, to those who are fond of natural history, and who have the means of scrutinising with due attention those wild and semi-aquatic places, in which members of the genus are most likely to be found.

In other parts of the world the species are still more numerous than they are in Europe, and some of them attain a larger size. They may all, however, be considered as swallowing serpents, rather than as killing their prey by crushing it to death, though many of them have considerable strength in their folds. They are all perfectly harmless to man, and, generally speaking, of very great service to him, both in the protection of his growing crops, and his magazines of grain. In warm countries the depredations committed by birds, are beyond any extent of which we, of these mild latitudes, have any idea. They come, one hardly knows whence, in flocks which absolutely darken the air, and are quite sufficient to consume the whole crop on a large plantation in the course of an hour or two. In many parts of India, indeed, and in other tropical countries, one of the severest species of field labour which the people are called upon to perform, is that of protecting their crops from the birds. In such countries stages are erected by the sides of all the little cultivated patches, and the youth are kept continually on the alert, hallooing and shouting to scare away the winged plunderers, which are to a very great extent noise proof. In those countries, at least in places where part of the land is under crop, and kept irrigated, so that there is a succession of insects from the supply of water, birds nestle and breed at all seasons; and were it not that there is some means of keeping down their constantly augmenting numbers, they would very speedily obtain the mastery of all nature; for we have evidence in various parts of the animal kingdom, that individual strength is of no avail whatever against combined numbers, be the individuals as weak as they may. We have proof that the antelope, the buffalo, nay even the lion himself in wild nature, may be starved to death by the invasion of the locust; and we sometimes feel in our own country, that the checking of vegetable action for a few days, and the consequent tendency to a saccharine state of the juices, will destroy the crop of our orchards in very brief space. Now when we consider that birds are individually much more voracious than locusts, although the latter ply a very willing tooth, yet we must admit that those means by which the excess of the smaller feathered creatures is kept down in tropical countries, is among the most beneficial to man; and this is a labour which snakes of this genus are incessantly and successfully performing.

COLUMBELLA (Lamarck; VOLUTA, Linnæus). These shells were classed by Linnæus with the genus

Voluta, from which they are, however, very distinct, having the interior part of the right lip or margin gibbous or thickened, rendering the aperture narrow and waved, and by having also a very small thin elliptical operculum, which latter circumstance, Sowerby observes, allies this genus to that of *Ricinula*. The shells of this genus are short, small, rather thick, often striated transversely, and much varied in colour; in some respects they appear allied to the genus *Mitra*. There are plaits on the columbella, it is more or less notched, and without a canal. The animal is not completely known, it is of the second class *Paracéphalophora*, first order *Siphonobranchiata*, first family *Siphonostomata*. These shells inhabit the seas of hot countries; about eighteen species are enumerated by Lamarck, and one fossil by De France.

COLUMBINE is the *Aquilegia vulgaris* of Linnæus. It is a native of Britain, but has a good many foreign associates. Their flowers are of very remarkable structure and bright colours, for which they have found their way into every flower garden.

COLUMELLIACEÆ. A natural order of dicotyledonous plants, which has been formed by Mr. Don, and which contains only a few genera as species. It is allied to *Jasminæ*, and corresponds with that order in the structure and æstivation of its corolla, in its bilocular ovary, and in the structure and dehiscence of its capsule; but it differs in having an adherent ovary, a perigynous disk, an undivided stigma, and an inferior capsule with many-seeded cells. The essential characters, as given by Don, are: calyx turbinate, superior, many toothed; corolla rotate, five to eight partite, with a convolute æstivation; stamens two; anthers linear, one to two celled; ovary inferior, two celled, with an indefinite number of ovules; style simple, declinate; stigma capitate; disk perigynous; fruit, a two celled, many seeded capsule; seeds ascending.

The plants belonging to this order are shrubs, trees, or herbs, with opposite entire leaves, and solitary yellow flowers. They grow in Mexico and Peru. Their properties are as yet unknown. The chief genera of the order are, *Columellia* and *Menodora*.

COLUMNEA (Linnæus). A genus of undershrubs and climbers, natives of the West Indies. Linnæan class and order *Didynamia Angiospermia*, and natural order *Scrophularinæ*. Generic character: calyx in five parts; corolla tubular, limb erect, and two lipped; upper lip hollow, elongated, and gibbous above the base, with acute reflexed segments on each side; lower lip spreading, and entire; stamens under the upper lip; anthers two celled, and placed close together; fruit a two celled, many seeded, berry. These are pretty flowering plants, and easily propagated by cuttings struck in sand; they are, however, easily lost if over watered or kept in a damp part of the stove.

COLUTEA (Linnæus). A genus of ornamental shrubs, natives of the south of Europe. They belong to *Diadelphia Decandria*, and natural order *Leguminosæ*. Generic character: calyx of five teeth; standard furnished with two callosities at the base; keel obtuse; stigma on the side and under the apex of a crooked style; pod on a footstalk, inflated, membranaceous. This plant is called bladder-senna in English lists, and is a favourite shrubby genus, as they flower abundantly, and ripen seeds, by which they are propagated.

COLYMBETES (Clairville). An extensive genus of coleopterous insects belonging to the section *Pentamera* subsection *Adephaga*, and family of the water beetles, *Dytiscidæ*. The species are of an intermediate size, and oval form. They frequent ponds, brooks, and other standing as well as running water; they are found throughout the year, but are most abundant in the spring and summer months; they swim with great agility, and may often be seen in hot weather to quit their native element and rise to a considerable height in the air with the assistance of their large wings. There are upwards of thirty British species, including the type *Dytiscus striatus*, Linnæus; they are generally distinguished by having the tarsi composed of five joints, the four anterior in the males are dilated into an oblong plate, the antennæ are as long as the head and thorax, and the scutellum is distinct.

COMARUM (Linnæus). A British plant found on most bogs, commonly called marsh-cinquefoil. It belongs to *Icosandria Polygynia*, and to the natural order *Rosaceæ*. This plant was called *Potentilla comarum* by Scopoli, an Italian botanist.

COMBRETACEÆ, the myrobalanæ family. A natural order of dicotyledonous plants, containing eighteen genera, and upwards of one hundred species. It is allied to *Myrtaceæ* and *Onagrariæ*, agreeing with those orders in the structure of the embryo and flower. It also bears a strong affinity to *Santalaceæ* and *Elæagnæ* among the monochlamydeous plants.

The essential characters of the order are: Flowers hermaphrodite, rarely polygamous; tube of the calyx adherent to the ovary, limb four or five-lobed, deciduous; petals either wanting, or from four to five in number, arising from the orifice of the calyx and alternate with its lobes; stamens inserted into the top of the tube of the calyx, double in number to its lobes, rarely equal or triple; filaments distinct, awl-shaped; anthers two-celled, bursting longitudinally; ovary one celled, with from two to four ovules, hanging from the extremity of the cell; style one, slender; stigma simple; fruit, a drupe, berry, or nut, one-celled, one-seeded, indehiscent, and often winged; seed pendulous, without albumen; cotyledons leafy.

The plants belonging to this order are trees or shrubs, with alternate or opposite stipuled leaves, and terminal or axillary spikes of flowers. They are found solely in tropical regions, and grow in various parts of India, Africa, and America. They possess in general astringent properties.

The order has been divided into two sections:—1. *Terminaliæ*, corresponding to the *Myrobalanæ* of Jussieu, in which the cotyledons are rolled spirally, calyx five cleft, petals wanting, and stamens ten in number. This division includes the genera *Terminalia*, *Bucida*, *Conocarpus*, &c.—2. *Combretæ*, the true combretum tribe, in which the cotyledons are thick, plaited longitudinally, calyx from four to five cleft, petals from four to five in number, and stamens varying from eight to ten. This section comprehends the genera *Combretum*, *Quisqualis*, &c.

The genus *Terminalia* contains thirty-six known species, many of which are important in a medical and economical point of view. *Terminalia vernix* furnishes a caustic poisonous juice, which is used in China as a varnish. The fruit of *Terminalia bellerica*, is rather larger than a gall-nut when dried, and is administered as a tonic and astringent. *Terminalia chebula* grows in the Malabar woods, and attains the height of eigh-

teen or twenty feet. Its bark and fruit possess powerful astringent properties, and are much used by the Hindoos in arts and manufactures. The flowers are also used in powder, to check bowel complaints. The bark of *Terminalia alata* is met with in the Indian bazaars. It is of a reddish brown colour, has a strong astringent taste, and is used in Ceylon in febrile cases. The juice of the leaves is poured into the ears for the purpose of allaying the pain of earach. The bark also dyes black, and the wood is used in building, and in the formation of boats. The kernel of the fruit of *Terminalia latifolia* is edible, and a decoction of the root of the plant is exhibited in Jamaica in cases of diarrhœa. The kernel of *Terminalia Catappa* has the taste and virtues of the almond. It also yields an oil which is used as an article of food. The tree supplies valuable timber. Its bark and leaves yield a black pigment, with which the Indians dye their teeth, and which is sometimes used in the formation of Indian ink. The fruit of *Terminalia citrina* is about the size of a French plum, and is made into a pickle. *Terminalia angustifolia* furnishes a resinous substance, similar to benzoin.

Laguncularia racemosa is one of the plants called mangroves in Brazil, and is used in Rio Janeiro for tanning. The bark of *Bucida Buceras*, known in the Antilles by the name of French oak, is also used for a similar purpose.

The genera *Combretum* and *Quisqualis* furnish some of the most splendid climbing plants of the tropics. When suspended from the trees in these regions, their white, crimson, and yellow flowers have a peculiarly showy and striking appearance.

COMBRETUM (Linnæus). A fine genus of ornamental climbers chiefly natives of Africa. Linnæan class and order *Oetandria Monogynia*, and natural order *Combretaceæ*. Generic character: calyx funnel formed and four lobed; petals four, inserted in the calyx; so also are the stamens, and opposite the petals; anthers two celled, and burst longitudinally; style pointed; fruit like a nut, containing one seed, and winged; seeds pendent. This beautiful genus is of but late introduction into our collections. In 1818 there were but two species, at present we have at least thirteen. They all thrive well in the compost usually made for stove plants, namely, loam and moor-earth. All the species may be increased by cuttings or layers.

COMBUSTION, SPONTANEOUS. There are many facts which lead to prove the existence of this extraordinary natural process. In ordinary cases the combustible substance is set on fire by its temperature being artificially raised by friction, percussion, or the application of some other burning body. Then heat and light are evolved; the body takes fire, and this is what is termed combustion. It arises from the particles of one substance entering into chemical combination with the particles of another; thus pit-coal or fire-wood entering into combination with the oxygen of the atmosphere yield a vast quantity of light and heat; and the more rapid the combination is which takes place, the more vivid is the light, the more intense the heat. Flame, therefore, is the volatilised matter of the combustible body entering rapidly into combination with the oxygen or gas that supports the combustion. In the case of a candle, the tallow or wax is converted into vapour, which enters into combination with the oxygen of the surrounding air,

and becomes heated to whiteness. The flame is a film of this hot white vapour, enclosing within it a quantity of the same vapour, which, when the outer film is consumed, comes in contact with the oxygen, and is in its turn consumed. Hereby the flame is sustained, and as the supply of vapour diminishes as it ascends, the flame tapers to a point. Several substances undergo combustion at a very low temperature. Phosphorus at the common temperature of the air undergoes slow combustion; it emits a white vapour, is luminous in the dark, and is gradually consumed. When combined with a certain quantity of hydrogen it forms a gas, which is so highly inflammable that it bursts into flame the moment it comes into contact with the atmosphere. The illuminating and heating qualities of the coal gas and oil gas are well known; they require, however, to be ignited before combustion takes place. The sources of combustion, or the circumstances which excite the combustible body into a state of combustion, are numerous and sometimes not easily determined. The cause of subterranean fires and volcanoes has been referred to the decomposition of pyrites or the metallic sulphurets which exist below the surface of the earth. Indeed the disengagement of heat is a constant result of chemical action; it is always evolved whenever a substance without change of form passes from a rarer into a denser state; as when a gas becomes a liquid; or a liquid solidifies. In fermentation so considerable a degree of heat is often evolved that visible combustion ensues; hence stacks of hay, turf, flax, hemp, &c., when put up wet, frequently take fire. The light and heat emitted during combustion vary with the nature of the combustible substance; the flame sometimes being white, yellow, blue, orange, or deep red; and the heat often very low, though the substance be ultimately consumed. Several bodies seem to contain light as a constituent, which in escaping renders them luminous, as if surrounded by a lambent flame, varying in colour according to the body whence it arises. The minerals which possess this property are called phosphorescent, as fluor spar, or phosphate of lime. Many animal substances part with their constituent light when they begin to putrefy; thus different kinds of meat and fish, as the haddock, herring, mackerel, when putrefaction commences, appear luminous in the dark. The source of the light and heat given out during combustion is not well understood; many consider the phenomenon entirely electrical. The combustibility of bodies, or their disposition to combine with a greater or less rapidity with oxygen, or any other gas which supports combustion, varies considerably. Many animal and vegetable substances in decomposing give rise to a combination between phosphorus and hydrogen, which produces the gas above referred to, which ignites immediately it comes in contact with the atmosphere. This is the cause of the ignis fatuus or will o' the wisp, which is charged with the sin of betraying weary travellers into bogs and quagmires. The secret, however, is that such places abound with animal and vegetable remains undergoing putrefaction. The mysterious visitants have been detected rising in the form of air-bubbles to the surface of the earth or water, and suddenly taking light. Their flickering motion too may be ascribed to the agitation of the air by which they are surrounded; so that these faery torches are by the stern exorcism of science divested

of all their supernatural character. Other inflammable gases have been often found existing in nature in a free state, and have been collected in large quantities. In the western part of the State of New York, forty miles from Buffalo, and two from Lake Erie, a village is lighted by its native gas. On removing an old mill, bubbles were seen to rise which were found to be inflammable. A company was then formed, a gasometer constructed, and upwards of a hundred burners were supplied with this gas. In China, near the town of Thsee-Lieou-Tsing, springs of inflammable gas have been found. If, according to M. Imbert, a torch be presented to the orifice of a well when the tube full of water is coming up, it inflames and produces a jet of fire from twenty to thirty feet high. These springs are employed for heating and lighting all the salt-works in the neighbourhood. Bamboo pipes carry the gas from the spring to the place where it is intended to be consumed. These tubes are terminated by a tube of pipe-clay to prevent their being burned. A single well heats more than 300 kettles. The fire so obtained is exceedingly brisk, and the cauldrons are rendered useless in a few months. Other bamboos conduct the gas intended for lighting the streets and the different apartments in houses; so that nature has herself supplied this place with a complete establishment of gas-light. It is added that in winter the poor people, in order to warm themselves, dig the sand to the depth of a foot; they then set fire to the gas arising from the hollow so formed, and sitting round it warm themselves as long as they feel inclined. They then fill up the hollow with sand, and the fire goes out. This singular circumstance arises from there being a vast number of coal mines in this district, which contain so much coal gas that it escapes into the strata around them.

When we consider the changes which are constantly taking place in the interior of the earth, it is by no means surprising that inflammable and sometimes poisonous gases should be evolved; it is, however, very remarkable that inflammable gas has sometimes been generated in the bodies of living animals. It is recorded that on opening the body of an ox, which had been some time sick, an explosion took place, and the flame, which rose to the height of more than five feet, scorched severely the butcher and a little girl who stood near him. A case was read by M. Bally to the Royal Academy of Medicine at Paris, of a man who, having been admitted into the Hotel Dieu ill with typhus, died emphysematous, that is, with air effused in the tissue below the skin, and when the skin was punctured a gas escaped, which was set on fire by the flame of a candle. It burned for some time; the flame being blue at its base, white at its summit, and as the body presented no signs of putrefaction, the air having been effused below the skin before death, it was inferred that it must have been generated during life. Another case, which was witnessed by Leduc, is related by Dencux; it is that of a lady from whose body during life a gas proceeded, which took fire and exploded. It is therefore certain that inflammable gases may be developed in the human body during life; and this fact has been adduced in explanation of that curious phenomenon, the spontaneous combustion of the human body. The assertion that the human body may of itself take fire and, with the exception perhaps of a few fragments of bone, be entirely consumed, appears so marvellous that the occurrence may well be at first

doubted; yet on inquiry we shall find that such a mass of evidence exists in proof of its having taken place, that the doubts and suspicions of the most sceptical must be set at rest. In the Transactions of Copenhagen we read that, in 1692, a woman of the lower class who for three years had used spirits to such an extent that she could take no other nourishment, having sat down one night on a straw chair to sleep, was consumed in the night time, so that next morning no part of her was found, excepting the skull and the extreme joints of the fingers. In the Annual Register for 1763, the case is recorded of the Countess Cornelia Bandi, of the town of Cesena, who died in a similar manner. This lady was in her sixty-second year, and well all day until night, when she began to feel a little heavy. After supper she went to bed, and, having talked two or three hours with her maid, fell asleep, upon which the maid servant left the room, closing after her the door. The next morning, on going to call her mistress, she found her corpse in this deplorable condition. Four feet distant from the bed was a heap of ashes, two legs untouched, stockings on, between which lay the head, the brains, half of the back part of the skull and the whole chin burned to ashes, among which were found three fingers blackened. All the rest was ashes which had this quality, that they left in the hand a greasy and offensive moisture. The air of the room had soot floating in it, and from the window a greasy yellowish fluid trickled. Of two candles on the table the tallow was gone, but the cotton left some moisture about the feet of the candlestick. The bed was undamaged, the blankets and sheets being raised on one side, as when a person gets out of bed. This case was published when it took place by Bianchini, the prebendary of Verona; it was also attested by Scipio Maffei, a learned contemporary of Bianchini; and finally confirmed to the Royal Society of London by Paul Rolli. The narration is followed by an inquiry into the cause of the conflagration, the result of which is that it was not from the lamp or a flash of lightning, but that the combustion began spontaneously.

Vicq. d'Azyr, Lair, Kopp, Dupuytren, and Marc, have related a number of other cases, from which, taken collectively, the following inferences have been deduced:—

1. Spontaneous combustion is a calamity almost peculiar to the old and feeble; and those who have suffered have in general been habitual and excessive indulgers in alcoholic liquors.

2. Women seem peculiarly prone to it: thus of seventeen cases collected by Kopp sixteen occurred to females, while the eight cases mentioned by Lair were all females.

3. The flame is of a lambent and flickering nature, of a blue colour, and not readily communicable to other inflammable bodies. Water not only does not extinguish, but frequently gives the flames additional activity.

4. The combustion proceeds with extraordinary rapidity; the decomposition of the entire body being usually effected in a very short space of time.

5. The trunk is generally entirely consumed; but portions of the skull and extremities have been occasionally found left.

6. A strong and peculiar empyreumatic odour is generally exhaled during the combustion, and upon adjacent objects there is found a greasy, moist, and fetid fuliginous deposit.

7. Winter is the season during which spontaneous combustion is most liable to occur, and it seems certain that the combustion in many cases has arisen spontaneously, or without the contact of any ignited body.

We are not aware that any analogous phenomenon has been observed among the inferior animals, or in the vegetable creation. The luminosity of insects—such as the glow-worm, fire-fly, lantern-fly, and of medusæ, which often illumine large tracts of the surface of the sea has however been supposed to arise from the slow combustion of some combination of phosphorus secreted from their fluids. It is not difficult to understand that the human body, when saturated with alcohol, may be the subject of such chemical changes as will render it combustible. There is a large quantity of phosphorus in the bones, and in other parts of the body, and it is easy to conceive that the excess of hydrogen introduced into the system by alcohol, may give rise to such a combination as will evolve the perphosphuretted hydrogen, a gas which, as above explained, takes fire spontaneously; and hence also, water which is composed of oxygen and hydrogen does not extinguish the flame, because it becomes decomposed itself, and its hydrogen uniting with another portion of phosphorus, increases the quantity of the inflammable gas. This theory is by some physiologists thought inadequate to explain all the phenomena that occur, and they therefore have recourse to the calorific power of the electrical fluid. We apprehend, however, that the above explanation is the most satisfactory, and therefore give it a decided preference. The most remarkable fact connected with spontaneous combustion is the rapidity with which the body has, in most cases, been consumed. It is well known that the ancients, in the ceremony of cremation, or the burning of the dead, used vast quantities of fuel; and, to expedite the process, added oil, fat, ointments, perfumes, &c.; yet, notwithstanding, the body was not consumed for a considerable time. Hence Achilles is described by Homer as having attended the burning of the body of Patroclus throughout the whole night. We also know that in the execution of those unhappy persons who were condemned by the inquisition to be burnt to death, a prodigious quantity of combustible materials was required; yet, in most of the instances of spontaneous combustion, the body, without any fuel, and in the space of a very few hours, appears to have been almost entirely reduced to ashes. Were not such cases attested by the most competent and unimpeachable authorities, they might well be doubted; who, however, can prescribe limits to the mysterious operations of nature? It is easy for the ignorant or the indolent to be sceptical, and deny the possibility of every occurrence that has not fallen within the narrow sphere of their own personal observations; the better informed and more philosophical mind, however, will pronounce no such rash judgment, but will pause, and attentively and patiently examine every phenomenon which appears to be well attested.

COMESPERMA (Labillardière). A genus of evergreen shrubs, natives of New Holland, Linnæan class and order, *Monadelphina Octandria*, and natural order *Polygaleæ*. Generic character: calyx of five sepals, deciduous; two of the sepals wing formed; corolla of one petal, three-parted; middle segment somewhat cup formed, often imarginate; stamens two bearing anthers; style tubular; capsule wedge shaped,

two celled, and two seeded. Admirable greenhouse plants, which thrive well in light loam and moor-earths but should never be too much soaked with water; to prevent which perfect drainage of the pots is necessary: increased by cuttings.

COMFREY. Is the *Symphytum officinale* of Linnæus. It is a very common British plant found growing on the banks of wet ditches. Some of the species have tuberous roots, and all are perennials. The rough comfrey, a native of Mount Caucasus, introduced about 1799, has been lately cultivated as an agricultural plant; the leaves being found an agreeable and nutritious green food for cows. The culture is only eligible, when no other agricultural plant can be conveniently raised.

COMMELINA (Linnæus). A genus of ornamental herbaceous plants, chiefly natives between the tropics, and belonging to the third class of Linnæus, and made a distinct order by Jussieu, under the title of *Commelineæ*. Generic character:—involucrum double and cupped; calyx of three sepals; corolla of three petals, one or more of the petals often abortive or wanting; stamens three, fertile, with three intervening glands, crossed; stigma simple; seed vessel three celled, three valved; seeds one in each cell. These are pretty blue flowering plants; they may be increased by seeds which ripen frequently, or by dividing the root. Some of them flower in the open air during summer; but if such have tuberous roots, they must be taken up before winter, and kept in dry sand out of the reach of frost.

COMMELINEÆ. The spider-wort family. A natural order of monocotyledonous plants, containing nine or ten genera, and upwards of eighty species. It is allied to *Xyrideæ*, and also to *Restiaceæ*.

The essential characters of the order are: perianth of six divisions, in a double series, outer tripartite, somewhat resembling a calyx, inner petaloid, with the claws of the petals sometimes cohering at the base; stamens six or fewer, hypogynous, some of them either deformed or abortive; ovary three-celled; style one; stigma one; capsule two or three celled, two or three valved, the valves bearing the dissepiments in the middle; seeds often in pairs, inserted by their whole side on the inner angle of the cell; embryo flat and circular; albumen fleshy.

The plants of this order are herbs, with leaves which are usually sheathing at the base. They inhabit marshy ground in both hemispheres, and are chiefly found in the East and West Indies and Africa. None of them are known in Europe except in cultivation. Many of them are elegant plants, sending forth beautiful clusters of blue, reddish, or white flowers. The first-mentioned colour is the prevailing one of the order.

The chief genera are, *Commelina*, *Callisia*, *Dichorizandra*, *Tradescantia*, *Cartonema*, *Cyanotis*, and *Aneilema*.

The genus *Commelina* was named in honour of two Dutch botanists, called Commelin. It contains nearly thirty species, some of which are showy, while others are mere weeds.

Callisia repens is a West India plant, remarkable for its shining leaves, which are edged with purple.

Tradescantia axillaris, or axillary spider-wort, is a native of the Malabar coast. A decoction of the plant is considered in that country as a useful remedy in dropsy and in flatulent affections of the bowels. Some of the species of this genus, which is found in

Jamaica, are looked upon as antidotes to the poison of spiders.

COMOCLADIA (Linnæus). A genus of large West Indian timber trees, belonging to the third class and first order of Linnæus, and to the natural order *Terebinthaceæ*. Generic character: calyx of three parts; corolla of three elongated petals; stamens short; style none; stigma simple and sitting; drupe of one seed. These trees have been described by Sloane, Swartz, and Jacquin; but they are of too large growth for cultivation in our stoves.

COMPOSITÆ. Composite Family. A natural order of dicotyledonous plants, containing between three and four hundred genera, and upwards of four thousand species. It is a very extensive and important order, and is at once recognised by the cohesion of its anthers, and its capitate flowers. On account of the former of these characters, the order has been denominated by some authors, *Synantheræ*. It is allied to *Calycereæ* and *Dipsacææ*, but differs from these orders in not possessing a pendulous ovulum, and in its anthers not being free.

The following are the characters of the order:—tube of the calyx adnate with the ovary; limb of calyx either wanting, or membranous, or divided into bristles, chaff, hairs, or feathers, called *pappus*; corolla regular and funnel shaped, or irregular and ligulate, sometimes two lipped, generally four or five toothed; stamens four or five, alternate with the teeth of the corolla; anthers cohering in a cylinder; ovary inferior, one celled, with a single erect ovule; one style; stigmas two, either distinct or united; fruit, a small, indehiscent, dry pericarp, crowned with the limb of the calyx or pappus; seed erect, without albumen; embryo straight; radicle directed to the hilum.

The plants belonging to this very natural order are herbs or shrubs, rarely trees, furnished with flowers (called *flosculi*, or florets) which are collected into dense heads on a common broad receptacle, and are surrounded by an involucre. Their leaves are alternate or opposite, without stipules, and usually simple. Among the flowers there exist frequently leafy or chaffy appendages, called *bracteas*. The *Compositæ* are not in general cultivated on account of their beauty, but the order includes several showy and ornamental garden plants.

The order has been variously subdivided by different botanists. In the Linnæan or artificial arrangement, it is included in the class *Syngenesia*, and is divided into sections, according to the sexes of the florets on different parts of the same head. Thus the first section is *Polygamia æqualis*, in which all the florets are hermaphrodite, or furnished with both stamens and pistils. The second section is *Polygamia superflua*, in which the florets of the disk or centre are hermaphrodite or perfect, and those of the ray or margin are furnished with pistils only, but all producing perfect seed. The third section is *Polygamia rustranca*, in which the florets of the disk are perfect, while those of the margin are neuter or destitute of pistils, as well as stamens, and the fourth section is *Polygamia necessaria*, in which the florets of the disk have stamens only, while those of the ray have pistils only, so that both are necessary for the production of perfect seed.

Jussieu, in his natural arrangement, has divided the *Compositæ* into three sections; I. *Cynarocephalææ*, or the artichoke tribe, in which all the florets are

flosculous or tubular; II. *Cichoraceæ*, the succory tribe, in which the florets are all ligulate or strap-shaped; III. *Corymbiferææ*, the corymbiferous tube, in which the florets of the centre are tubular, while those of the circumference are ligulate.

Cassini, Lessing, and Brown, have devoted particular attention to this order, and have divided it into a great number of sections. As these divisions are too minute to be interesting to the general reader, we conceive that it is unnecessary to enter into any details with regard to them. In the observations which we propose to make on the order we shall adopt Jussieu's division, which is the most simple, and the best adapted for a work like the present.

Composite plants are found abundantly in all parts of the world, and are said to constitute almost one-twelfth of the known vegetable productions of our globe. In different countries, the proportion which the *Compositæ* bear to the other phænogamic plants varies considerably. Humboldt states that they constitute one-seventh of the flowering plants of France, one-eighth of those of Germany, a fifteenth of those of Lapland, a sixth of the North-American Flora, and one-half of those of America within the tropics. They form only a sixteenth part of the Flora of New Holland, and the same proportion of the Flora of Melville Island. In their relative increase and decrease, they do not appear to follow any general law of climate. It may be stated generally that the *Cichoraceæ* are chiefly found in cold, and the *Corymbiferææ* in warm regions. The *Compositæ* are herbaceous in the colder quarters of the globe, and become shrubby as we approach the equator.

If we examine attentively the plants belonging to this vast family, we shall find that they are not only naturally grouped together by their structure, but that they also agree remarkably in the medical properties with which they are endowed. They are all more or less tonic and stimulating; they contain a bitter, extractive, milky principle, and a volatile oil which is often solid and concrete, and has a strong resemblance to camphor. Each of the Jussieuan subdivisions of the family present some distinguishing peculiarities in their properties, and we shall therefore notice them separately.

I. **CYNAROCEPHALÆÆ**. The plants in this subdivision of the order possess intensely bitter properties, owing to the presence of much extractive matter, and they act chiefly as tonics. By cultivation, however, this bitterness is much lessened, and the plants in some cases become edible. The volatile oil, characteristic of the family, is not very abundant in this division. Under this division are included the genera, *Cynara*, the artichoke and cardoon, *Carduus*, *Cnicus*, *Onopordum*, *Carthamus*, *Arctium*, *Carlina*, *Centaurea*, &c.

Cynara Cardunculus, common cardoon, was originally a native of the south of Europe and north of Africa, but is now found in various parts of the world. It bears the climate of Britain well, and is said to have been cultivated at Holyrood palace so early as the year 1683. It is an ornamental plant in a shrubbery or large garden. It abounds in the vast plains or pampas of the Cordillera, in South America, and its growth in that part of the world is said to be very rapid. It is stated by a recent traveller in South America, that on the pampas, cardoons shoot up to the height of ten or eleven feet, and come into full flower in the course of a single month. The road

and view become completely obstructed by them, and their prickly stems form a barrier of a most impenetrable nature. The same traveller remarks that, though it would be an unusual misfortune in military history, yet it is really possible that an invading army, unacquainted with that country) might be imprisoned by these plants before it had time to escape from them.

There are several varieties of cardoon which are cultivated as culinary vegetables. The seeds are sown in a deep light soil about the middle of April, and by the end of October the plants have attained their full size, and are ready for blanching. This operation is performed by binding the leaves close together with a wreath of hay or straw, and covering them with earth for a month or six weeks. The stems and mid-ribs of the leaves are stewed, or eaten as a salad. They are also boiled in soups. The florets of the cardoon are used in Buenos Ayres and in France instead of rennet, for coagulating milk.

Cynara scolymus, the common artichoke, has been considered by some as merely a variety of the cardoon, depending on the cultivation. This opinion requires confirmation, and as yet we have not sufficient data to enable us to come to a satisfactory conclusion. The artichoke differs from the cardoon in its broad spineless leaves, its humble growth, and its large fleshy heads. The plant comes originally from the south of Europe, and was cultivated in England so early as the year 1580. It is capable of sustaining great and long-continued drought. In the hot season of 1825, it was almost the only vegetable to be got in the neighbourhood of Paris for three or four weeks in the months of July and August. Once in the seventeenth century, and again about 1739, most of the artichokes in England were destroyed by frost, and recourse was had to France for a new supply. There are several varieties of artichoke in cultivation, the chief of which are the green or French. The globe and dwarf globe artichokes are propagated by suckers, in the months of March and April. They require a light well-manured soil, and are planted in rows four feet distant, and two feet apart in the rows. They produce a few heads the first season, and a full crop the next; and, if well manured, they will last for five or six years. In winter, the plants are covered with dung about a foot thick, which is removed in March and April when the ground is dressed. The artichoke, in its wild state, is more downy and spinous than when cultivated in the kitchen garden; the heads also are much smaller.

The heads of the artichoke are gathered in the unripe state before the flower expands, and are boiled in salt and water until all the parts are soft which are capable of becoming so. The scales are then taken off one by one, and their lower part being dipped in a mixture of butter and pepper, all the fleshy part is sucked off. Very little is obtained in the way of solid food, the butter forming the chief part of the dish. After the scales are taken off, there remains the receptacle or bottom, with a mass of unexpanded florets and bristles, called the *choke*. The latter being removed, there remains the proper receptacle or *cul* which is the most valuable part of the artichoke. Many people are very fond of artichokes. In France and Italy they are much more used than in this country, and they are often eaten in those countries in a raw state.

Artichokes contain little nourishment, but they are easily digested, and hence are sometimes useful for

convalescents. They possess diuretic and diaphoretic properties. The root is bitter, and is considered by the Arabians as laxative, while the gum which it furnishes is classed by them among the emetics. The receptacles of the artichoke may be preserved during the winter, by being blanched in hot water, and carefully dried.

The genera *Cnicus* and *Carduus* include most of the thistle tribe. These two genera are distinguished from each other by the pappus being feathery in the one, and only rough in the other. Thistles are propagated with amazing rapidity, on account of the down attached to their seeds, by means of which they are easily carried by the winds in all directions. They are a very troublesome set of plants, and prove a great annoyance to the farmer. Ever since the time that the Almighty pronounced this sentence on the earth, "Thorns also and thistles shall it bring forth to thee," these weeds have continued to infest the ground, and man has been forced to eat bread in the sweat of his brow. The *Cnicus arvensis*, or creeping thistle, is one of the most difficult to extirpate, in consequence of the numerous deep roots which it puts forth. These noxious weeds, however, although at first sight they might appear to be of no use, have important purposes in the economy of nature, affording by their seeds and leaves nourishment to numerous tribes of birds and insects with which the earth is peopled. Some of the thistle tribe are also turned by man to useful account: the footstalks of their leaves, and their receptacles, being used by him as food. The flowers of several of the species are used in Europe for curdling milk.

The handsomest native species of thistle are, *Carduus nutans*, *Cnicus eriophorum*, and *heterophyllus*. The first of these is said to smell powerfully of musk in warm weather, more especially in the evening, and hence it has been called musk thistle. *Cnicus eriophorum*, woolly-headed thistle, is so named on account of the large quantity of woolly matter which is interwoven with the scales of the involucre. *Carduus Marianus* has been denominated milk thistle, on account of the milky veins on its leaves. The root and leaves are very bitter, and the expressed juice was formerly used in dropsy, jaundice, chronic rheumatism, and intermittent fever. *Onopordum acanthium*, common cotton thistle, although not belonging to the true thistle tribe, and but rarely found in Scotland, is still commonly cultivated as the true Scotch thistle. Its seeds are much eaten by birds, and are not so liable to be blown about as those of the other thistles already noticed.

Carthamus tinctorius, safflower, is a native of Egypt and eastern countries, and is cultivated in many parts of Europe and the Levant, on account of its flowers, which are dried and exported in large quantities, in order to furnish a deep yellow dye, like saffron. The flowers furnish two colouring principles very important in dyeing; one soluble in alkalis, presenting various shades of red, and another soluble in water, of a yellow colour. The first is employed particularly by the Chinese, to give different red tints to silk, and bears the name of *Carthamite*. When mixed with finely powdered talc, it is used by the Parisian ladies as a cosmetic rouge, under the name of vegetable rouge, or lake of *Carthamus*. The plant was introduced into England in the year 1551, and in 1683, twenty-five acres of ground in Gloucestershire were sown with its seeds. In Spain it is grown in gardens for the pur-

pose of colouring soups, and the Jews in Poland employ it much in their viands. The seeds are purgative, and have been recommended in dropsy. Though bitter, they are eaten by birds, especially by parrots, and hence they are sometimes called parrot grains.

Carthamus lanatus is used by the women in the south of France and Spain for distaffs, and hence it is denominated distaff thistle.

Arctium lappa, common burdock, and *Arctium Bardana*, which seems to be merely a variety with a downy calyx, are well known on account of the hooked scales of their involucre, by means of which the heads fasten themselves most pertinaciously to clothes and the coats of animals. The seeds are oily and bitter, and the whole plant possesses diuretic, diaphoretic and aperient qualities. The root contains carbonate and nitrate of potass; and a decoction of it has been used as a substitute for sarsaparilla, and administered in cutaneous and rheumatic affections. The juice of the leaves mixed with oil forms a liniment which has been used in dressing wounds and ulcers.

Centaurea benedicta, blessed thistle, a native of the Grecian islands, is accounted a stomachic, and its seeds are used to produce perspiration. An extract from the plant has been recommended in the catarrh of children. *Centaurea calcitrapa*, common star-thistle, possesses febrifuge virtues. Its roots were formerly considered useful in calculous complaints, and its leaves and flowers were prescribed in ague. *Centaurea cyanus*, corn blue-bottle, has been sometimes employed medicinally. The juice of its flowers is used as a kind of ink, and stains linen of a blue colour.

Carlina acanthifolia is a wholesome article of diet. *Carlina acaulis* has black woody roots, an inch in thickness, the upper part of which, as well as the receptacle of the flowers, may be eaten. The flowers of *Echinops strigosus* are used in Spain for tinder.

II. CICHORACEÆ. Most of the plants of this tribe yield a milky juice, which is bitter, astringent, and slightly narcotic. To this juice they owe their medical properties; and, when it exists in great quantity, the plants may be looked upon with some degree of suspicion. Many of the *Cichoraceæ* are employed as articles of food, either in a young state, before the bitter narcotic juice is fully formed, or in a more advanced state, after being blanched. By cultivation a great change is often effected in their qualities.

The chief genera included in this sub-division of composite plants are, *Cichorium*, the succory and endive; *Lactuca*, the Lettuce; *Sonchus*, *Leontodon*, *Scorzonera*, *Tragopogon*, *Hieracium*, *Apargia*, *Lapsana*, &c.

Cichorium intybus, common wild succory, is met with chiefly on gravelly and chalky soil, in several parts of Britain, and is very abundant on the continent. It bears numerous large bright but pale blue flowers, which close during the night, but expand on the first approach of morn. The plant was eaten by the Romans, and is still used as an article of food in France. The seeds are sown in July, and the plants are allowed to grow six inches apart. In winter the roots are taken up and packed in a warm cellar among earth, the upper portion being the only part exposed. In this situation, young leaves are quickly produced, in a blanched state, fit for being used as a salad. The leaves and root are very bitter in a wild state, less so when cultivated. The juice of the fresh leaves acts as a tonic, and a stomachic syrup is prepared from them. The root, when dried and roasted, has an agreeable bitter flavor, and is used on the continent as a

substitute for coffee. At one time when the latter article bore a high price in the market, succory was much used in France, and it is still employed in that country, although it certainly wants the fine aroma of the Arabian grain. The herb in a luxuriant cultivated state, is an excellent early fodder for cattle.

Cichorium endivia, common endive, is a native of Japan and China, and is cultivated in gardens for the purpose of furnishing the salad which bears its name.

The genus *Lactuca*, lettuce, furnishes several species, three of which, *Lactuca virosa*, strong-scented lettuce; *scariola*, prickly lettuce; and *saligna*, least lettuce, are natives of Britain. *Lactuca virosa*, wild or strong-scented lettuce, yields a milky juice, having a disagreeable and well-marked narcotic odour. In its medical properties and effects, it bears a considerable resemblance to many of the *Solanææ*. An extract is prepared from it, which is used as a substitute for opium. A large quantity of this plant was cultivated about a year ago in the neighbourhood of Edinburgh, by a celebrated druggist of that town, and the concrete juice procured from it was sold extensively in the London market.

Lactuca sativa, common lettuce, is another species of the genus. This plant has been cultivated in gardens, almost from time immemorial, and its native country is not known. There are several varieties of cultivated lettuce. The leaves of all have a fresh, watery, and somewhat bitter flavour, and are used much as a salad. Lettuce thrives well both in temperate and warm regions.

The inspissated juice of this, as well as the former species, is called *lactucarium*, and was first introduced into notice by Dr. Duncan of Edinburgh. This substance is called by the French physicians *thridace*, from the Greek word for lettuce. Although lactucarium is procured from both species of lettuce, still the *lactuca virosa* yields it in greatest quantity. The juice, which exists chiefly in the vessels immediately under the cuticle, ought to be collected at the time when the plant is in flower, and the mode of procedure is as follows:—Transverse incisions are made successively in the stems of the plants, and the white or milky juice, which exudes copiously, is scraped off. It is then put into glass or porcelain vessels, and allowed to concrete by exposure to the air. It thus assumes a brown colour. The *thridace* of the French is procured by expressing the juice, and consequently it is not so pure as the British *lactucarium*.

Lactucarium varies much in purity, according to the season, as well as the mode of its preparation. It often contains a great quantity of caoutchouc, which, of course, interferes much with its properties. It has much of the taste and odour of opium, and exerts a soothing anodyne effect upon the system. Duncan, Young, Scudamore, Bidaut, and Francis, have used it extensively in the cure of diseases. It may be administered in most cases where the use of opium is indicated in doses of five, ten, or even twenty grains. It would seem not to produce the prejudicial effects which often attend the use of opium. The narcotic principle of lactucarium has not yet been procured in a separate state. No morphia could be obtained from it. Lactucarium has also been used as a diuretic in cases of dropsy and water in the chest.

The soporific effects of lettuce have been long known. Galen is said to have used it much in the decline of his life, on account of constant wakefulness.

The seeds of the lettuce also possess narcotic qualities, and the leaves when boiled in water have been used as soothing poultices.

Lactuca quercina, *Palmata* and *Intybacea* are cultivated by the French as salads.

Sonchus oleraceus, common sow-thistle, possesses diuretic and laxative properties. The young tender leaves of this plant, as well as those of *Sonchus arvensis* and *palustris*, are eaten as greens in some countries. In Rome and Florence, *Sonchus tencrimus* is used as a salad. Swine are said to be fond of these plants, and hence the English name *sow-thistle*, which has been applied to them. *Sonchus Alpinus* bears numerous large blue flowers, and is the rarest British species. It is found only in one or two stations in the Gramian range.

Leontodon taraxacum receives the names of *Dent de Lion*, *Dandelion*, lion's tooth, from the deep tooth-like divisions of its leaves. The plant has a considerable degree of bitterness, but when blanched like endive, it may be used as a salad. The tender young leaves, in consequence of being less bitter, are often used for this purpose. The root resembles a carrot, and yields a bitter milky juice, which loses its bitterness by drying. When roasted, it is used by the common people in some parts of Germany as a substitute for coffee. Medically dandelion acts as a tonic and diuretic. The expressed juice of the leaves is said to be useful in chronic cutaneous diseases, and in abdominal obstructions. In jaundice and diseases of the liver it has also been frequently employed. The plant is a troublesome weed, and is extirpated with great difficulty.

The genus *Scorzonera* derives its name from the Catalonian word for a viper, the plant being considered in Spain to be a remedy for the bite of that reptile. The root of *Scorzonera Hispanica*, garden or Spanish viper's-grass, is carrot-shaped, about the thickness of a finger, and bears some resemblance to the body of a viper. When deprived of its outer skin, and boiled or stewed, it forms an agreeable article of food. The plant is said to possess diuretic, stimulant, and sudorific qualities. The genus *Tragopogon*, goat's-beard, furnishes several species, three of which are natives of Britain. *Tragopogon pratensis*, common goat's-beard, bears yellow flowers, which close every day before noon. *Tragopogon porrifolius*, salsify or purple goat's-beard, has a long, fleshy, white root, possessing a mild sweetish flavour, which was formerly used in Britain as an article of food. The plant bears large purple flowers, which close before noon, or in rainy weather.

Several of the plants belonging to this section of the *Compositæ*, act as horological flowers, their petals expanding and shutting regularly at particular hours in the day. We have examples in the common goat's-beard, the common succory, the common sow-thistle, dandelion, and various species of *Hieracium* or hawk-weed. These plants act thus as silent monitors, warning us of time's rapid flight. To use the poet's language—

"In every copse and sheltered dell,
Unveiled to the observant eye,
Are faithful monitors who tell
How pass the hours and seasons by.

"The green-robed children of the spring
Will mark the periods as they pass,
Mingle with leaves Time's feathered wing,
And bind with flowers his silent glass.

"See *Hieracium's* various tribe
Of plummy seed and radiate flowers,
The course of time their blooms describe,
And wake or sleep appointed hours.

"Broad o'er its imbricated cup
The *Goatsbeard* spreads its golden rays,
But shuts its cautious petals up,
Retreating from the noontide blaze.

"On upland shores, the shepherd marks
The hour when, as the dial true,
Cichorium to the towering lark
Lifts her soft eyes serenely blue.

"Thus in each flower and simple bell,
That in our path betrod den lie,
Are sweet remembrancers who tell
How fast their winged moments fly."

III. CORYMBIFERÆ. The plants belonging to this subdivision are in general very active in their qualities, and supply various therapeutical agents. Like the other *Compositæ*, they contain a bitter principle; and in the composition of many of them we find large quantities of volatile oil and camphor. To the existence of these substances we trace the powerful aromatic odour which many of them emit, as well as their stimulating medical properties. The principal genera included in this section are, *Anthemis*, chamomile; *Achillæa*, *Helianthus*, *Absinthium*; *Artemisia*, wormwood; *Tanacetum*, tansy; *Balsamita*, *Matricaria*; *Calendula*, marigold; *Arnica*, *Inula*, *Tussilago*, *Gnaphalium*, *Senecio*, *Dahlia*, *Bellis*, &c.

Anthemis nobilis, common chamomile, is a perennial plant, found native in the southern counties of Britain. It is cultivated in gardens for the sake of its flowers, which are easily rendered double, and are used medicinally. The plant diffuses a highly aromatic and agreeable odour owing to the presence of a blue volatile oil, which may be procured by distillation. Besides this oil it contains camphor, gum, resin, and a small quantity of tannin. An infusion of the flowers is used as a tonic, stimulating, diaphoretic drink. It is also employed as a febrifuge, and has been administered with success in slight agues. It produces vomiting, and is useful in aiding the effect of other emetics. Chamomile is used as a remedy in spasmodic diseases, such as hysteria and colic. The flowers are applied externally as a discutient and emollient.

Anthemis cotula, stinking chamomile, is another British species, which is found in waste places, in corn-fields, and by way-sides. The whole plant emits a very disagreeable fetid smell, and is said to blister the hands of those who gather it. On examination with the microscope, it is found to be covered with small glands, which probably contain an acrid fluid. The plant is a stimulant, antispasmodic, and is used in nervous diseases.

Anthemis pyrethrum, pellitory of Spain, is a native of Spain, Barbary, and other warm countries, but bears the ordinary winters of this country well. The root, when pulled up and applied to the hand, communicates a peculiarly cold sensation. When chewed it produces a copious secretion of saliva, and a pricking sensation in the tongue. It is used in toothach, headach, and palsy of the tongue. It contains volatile oil, gum, and muriate of lime.

Anthemis tinctoria, ox-eye chamomile, supplies a beautiful yellow colour, and is used in dyeing.

Achillæa millefolium, common yarrow or milfoil, is found abundantly in pastures and by way-sides in this country. From its astringency it is used in the

Highlands for the purpose of healing wounds. The root has been proposed as a substitute for snake-root.

Achillæa ptarmica, sneezewort yarrow, when dried and powdered, is employed as an errhine. The root, when chewed, produces salivation.

Achillæa nana, and several other species, are used by the inhabitants of the Alps to give an aromatic flavour to vinegar.

Helianthus annuus, common sunflower, is a well known border annual, which receives its name from the popular supposition that its large heads of flowers follow the sun in its course. The plant is common in gardens, and was originally brought from Peru. The whole plant, but especially the flower, gives out a thin resin resembling Venice turpentine. The seeds, when roasted, are used as a substitute for coffee, and an edible oil is procured from them.

Helianthus tuberosus, Jerusalem artichoke, is a native of Brazil, but has been naturalised in most countries of Europe, and is cultivated on account of its use in rural and domestic economy. The root of the plant consists of oblong tubers, which are used as a substitute for potatoes, and form a wholesome and agreeable article of diet. The roots are very productive. Between seventy and eighty tons of tubers are said to have been obtained in one season from a single acre of ground. When boiled, the roots have a sweet taste similar to the artichoke. The plant may be reared on very poor soil with advantage, but its roots are not so much employed as the potato, on account of the latter containing more nutritive matter in its composition. Chemical analysis has shown that a peculiar principle, similar to that which is found in the dahlia, exists in the root of the Jerusalem artichoke. The roots when subjected to fermentation yield a spirituous liquor.

Absinthium officinale or *Artemisia absinthium*, common wormwood, is an aromatic bitter plant, common in Great Britain. It contains a large quantity of a green volatile oil. The plant possesses tonic and stimulating qualities, and is used to increase the action of the stomach, as well as for the cure of intermittent fever. It is frequently given to expel worms. It is administered in the form of powder, in doses of one or two scruples, also in infusion, and as a wine and a tincture. The green liquor called, in France, *eau d'absinthe*, and employed by gourmands to increase their appetite, is prepared from the plant by the addition of alcohol and subsequent distillation.

Artemisia is another genus of this order. It differs from *Absinthium* in the want of hairs on the receptacle. It includes several species, four of which are natives of Britain.

Artemisia vulgaris, mugwort, is not so bitter and aromatic as *Absinthium*, and has a less powerful action on the human frame. It is a stimulating tonic, and exerts a peculiar action on the uterine system. Its root has been recommended in epilepsy. In some parts of Sweden the plant is used in place of hops to increase the inebriating quality of malt liquors.

Artemisia dracunculæ is a native of Siberia, but is commonly cultivated in gardens. The leaves have an aromatic fragrant taste, and are used as an ingredient in pickles and salads. An infusion of the plant in vinegar forms a good fish-sauce.

Artemisia Santonica or *Judaica*, wormseed, is found in Arabia, Judea, and the countries in the north of Africa. The heads, seeds, and upper twigs of this plant, mixed with those of another species found in

Persia, and called *Artemisia contra*, are known in commerce by the name of *Semen contra* or *Sementina*. There are two varieties of *Semen contra*, one coming from the Levant, and the other from Barbary. The first is the best, and held in greatest repute. It is chiefly administered as a vermifuge in doses of twenty or thirty grains mixed with calomel or rhubarb.

Artemisia abrotanum, southernwood, is a perennial shrub, a native of the south of Europe, but common in gardens. It has a strong smell, and yields a fine green tincture. It is administered as an anthelmintic and sudorific, and is also employed externally as a fomentation. In the form of lotion or ointment it is applied to cutaneous eruptions, and is said to prevent the hair from falling off.

Artemisia Chinensis, mugwort of China, furnishes the moxa used by the Chinese as a cautery. This is a soft woolly substance, prepared from the young leaves of the plant by beating them, when thoroughly dried, and rubbing them in the hands till the fine fibres only are left. A little cone of this substance is laid on a diseased part, previously moistened, and is then set on fire at the top. It thus burns slowly down, producing a dark spot on the skin, which ultimately sloughs and produces an eschar. This mode of treatment is much used in eastern countries. The moxa used in this country and in France is generally made of cotton or linen rag, dipped in saltpetre, and rolled up tightly in a circular form. It is frequently employed as a powerful means of counter-irritation in diseased joints, &c.

Tanacetum vulgare, common tansy, is a well-known native plant. It has a strong, disagreeable, aromatic odour, and a bitter pungent taste. Its stimulating qualities are owing to the presence of a great quantity of essential oil. It is administered in the form of powder and infusion, as a remedy for worms and gout; and it is praised as an anti-spasmodic by some authors. The young leaves are sometimes employed to colour and flavour puddings.

Balsamita suaveolens is often cultivated in gardens. It has a strong odour, and possesses stimulating anti-spasmodic qualities. When steeped in oil, it is looked upon as a good application to wounds and bruises.

Balsamita vulgaris, costmary, from being put into ale, sometimes receives the name of *Cost-ale*.

Matricaria chamomilla, wild chamomile, has properties similar to those of the true chamomile. It is, however, much less powerful, and is now seldom used.

Pyrethrum Parthenium, common feverfew, has stimulating aromatic properties, and is employed in various fluxes.

Calendula officinalis, common marigold, is a well-known showy ornament of gardens, even that of the humblest cottager. It was introduced into this country, from the south of Europe, in the year 1573. Linnaeus says, that its flowers expand from nine in the morning till three in the afternoon—

“The Marigold that goes to bed with the sun,
And with him rises weeping.”

Its flowers are used in some parts of England to give colour and flavour to soups, and a distilled water and a kind of vinegar have been prepared from them.

Arnica montana, German leopard's bane, is found on the Alps and Pyrenees, as well as in various parts of Germany, Sweden, and Lapland, and was first cultivated in Britain in 1759. The flowers are of a

yellow colour, and contain an odoriferous resin, bitter nauseating matter, yellow colouring matter, gallic acid, gum, albumen, and some salts. In its recent state the plants excites sneezing in those who smell it. The flowers and root are used medicinally.

The plant has a bitter, acrid, and nauseous taste, and possesses stimulating properties. It produces a peculiar effect on the brain and nervous system, giving rise to headach, spasmodic motions of the limbs, and difficulty of breathing. It has been used in intermittent fever and dysentery; and of late has been prescribed in palsy, blindness, and various nervous affections. It is administered in the form either of infusion or powder. The dried leaves are sometimes used as a sternutatory in place of tobacco. When given in too large doses, arnica excites a feeling of anxiety, shooting and burning pains, vomiting, giddiness, and insensibility. In these alarming symptoms, vinegar is said to be the best remedy.

Inula Helenium, elecampane, is one of the largest herbaceous plants of Britain. Its root contains albumen, a volatile concrete oil like camphor, and a peculiar starch-like matter called *inulin*, which does not gelatinise on the addition of hot water, but remains in the form of powder. Elecampane is tonic, stimulant, and diuretic. It is sometimes prescribed in the form of infusion, powder, or wine, at the conclusion of catarrhal affections.

The young branches of *Inula crithmifolia* are sold in London as a substitute for samphire. *Pulicaria dysenterica*, common flea-bane, a plant found in marshy places in Britain, is sometimes recommended in dysenteric affections. *Spilanthes oleracea* has a hot penetrating taste, and is one of the most powerful anti-scorbutics which we possess.

Santolina chamæcyparissus, cypress-leaved lavender cotton, has properties similar to tansy, while *Solidago virgaurea*, common golden rod, is diuretic, aperient, and vulnerary.

Eupatorium perfoliatum, known in North America under the name of *Boneset*, possesses important tonic and diaphoretic properties.

Eupatorium Ayapana is celebrated for its power of curing the bites of serpents; and *Mikania Guaco* is used in Spanish America for a similar purpose.

The various species of *Guaphalium* and *Xeranthemum* constitute the plants commonly known by the name of *Everlasting*. *Coreopsis tintoria* is a very handsome border annual, and *Chrysanthemum Sinense* is one of the handsomest autumnal flowers. *Asters*, Christmas daisies, or star-worts, although not of much beauty, are prized on account of their flowering late in the season. China asters are familiar to all as annuals.

Bellis perennis, common daisy, so abundant in every pasture, is too often despised on account of the frequency of its occurrence. How different are the feelings with which this plant is contemplated by natives of Britain, when resident in countries where the daisy is not indigenous. How many pleasing and delightful associations does it in such circumstances awaken, when, perchance, it springs up along with other exotics! Among some English earth, in which seeds had been conveyed to Dr. Carey in India, there sprang up to his great delight the *daisy*; and this he perpetuated as an annual, raised by seed preserved from season to season. The feelings excited in Dr. Carey's mind by this incident are beautifully depicted by Montgomery in his "Daisy in India."

Thrice welcome little English flower!
My mother-country's white and red,
In rose or lily, till this hour,
Never to me such beauty spread;
Transplanted from thine island bed,
A treasure in a grain of earth,
Strange as a spirit from the dead,
Thine embryo sprang to birth.

Thrice welcome little English flower!
Of early scenes belov'd by me,
While happy in my father's bower,
Thou shalt the blithe memorial be;
The fairy sports of infancy,
Youth's golden age and manhood's prime,
Home, country, kindred, friends, with thee,
I find in this far clime.

Thrice welcome little English flower!
To me the pledge of hope unseen;
When sorrow would my soul o'erpower,
In joys that were, or might have been,
I'd call to mind how fresh and green
I saw thee waking from the dust;
Then turn to heaven, with brow serene,
And place in God my trust.

Tussilago farfara, coltsfoot, is common in moist clayey soils in this country. The flowers appear early in spring before the leaves. The plant is mucilaginous, bitter, and astringent, and in the form of infusion is used in chronic catarrhs, accompanied with cough and expectoration. The leaves are sometimes smoked like tobacco, for the relief of asthmatic complaints. The down, or cottony web covering the leaves, is used as tinder, and as a styptic for slight wounds.

The flowers of *Petasites vulgaris*, common butterbur, are of a pale flesh colour, and grow in the form of a thyrsus. In consequence of the plant flowering early, it is placed by the Swedes near their bee-hives.

The species belonging to the genus *Senecio*, or groundsel, are found in every part of the world, more especially in South Africa. Humboldt has observed that they are very numerous in the upper regions of the Andes, just below the limits of eternal snow. The flower buds and young tops of the leaves serve as food for birds, and canaries are particularly fond of them.

The genus *Dahlia* is named after Andrew Dahl, a Swedish botanist, and a pupil of Linnæus. *Dahlia superflua*, is a native of Mexico. Till the peace of 1814, this plant was much more cultivated in France than in Britain. It has now become a very fashionable plant in this country, and is considered one of the finest ornaments of our gardens. The flowers are showy, and continue to expand late in the season. There are numerous single and double varieties of the dahlia; the former being procured from seeds, the latter from cuttings, graftings, and divisions of the roots. The roots are taken up in winter and kept dry, and are again planted out in April. Benzoic acid is said to exist in the dahlia.

From the remarks which have been made on this comprehensive order, it will be seen that it contains plants possessing valuable medical properties, and that it also furnishes many of those vegetables which are used for culinary purposes. Whether we regard the vast number of species which this family contains, their wide distribution over the globe, or the highly important qualities with which they are endowed, we must consider it as occupying a distinguished place among the various tribes of vegetables which diversify the surface of the earth.

COMPTONIA (Banks). A North American deciduous shrub, named in honour of, and to perpetuate the memory of Henry Compton, bishop of London, an indefatigable collector of useful plants in

the early part of the last century. Linnæan class and order *Monœcia Triandria*, and natural order *Amentaceæ*. Generic character:—male catkin cylindrical, loosely imbricated; scales one-flowered; perianth of two leaves; corolla none; filaments three, forked; anthers six, two valved. Female catkin ovate, thickly imbricated; scales one-flowered; perianth of six leaves; styles two, like hairs; nut one-seeded. The leaves of this shrub are somewhat like those of fern, it thrives on light sandy loam and moor-earth, and is increased by layers.

CONANTHERA (Ruiz and Pavon). A genus of Chilian bulbs, belonging to *Hexandria Monogynia*, and to the natural order *Asphodeleæ*. Though not so splendid as others of the same class and character, they are, however, interesting, and well worthy cultivation. Mr. Sweet observes of this genus—"We believe that this and some other nearly related ones, would succeed better if out in a frame, on a warm border, and be covered with a mat or other covering in severe weather, than they do in pots."

CONCHACEA. The eighth family of the third order *Lamellibranchiata*; third class, *Acephalophora*, of De Blainville's system. It includes the genera *Cardium*, *Donax*, *Tellina*, *Lucina*, *Cyclas*, *Cyprina*, *Mactra*, *Erycina*, *Crassatella*, *Venus*, *Venerirupis*, *Coralliophaga*, *Clotho*, *Corbula*, *Sphæna*, and *Ungulina*. The shells of this family are all of them bivalve, and constitute a numerous portion of the most beautiful molluscs. The general characteristics are:—the shell nearly always regular; perfectly closing; equivalve, the summit recurved forward; the hinge, dorsal and complete, that is, with teeth and ligament, either exterior or interior, short and swollen; two distinct muscular impressions.

The mantle of the animal is closed in front, above, and backwards, where it is prolonged by two tubes more or less long, extensible, either united or separate, the abdomen constantly furnished with a foot, varying somewhat in form, which is its only organ of locomotion. All the animals of this family live concealed in the sand or mud, at a greater or lesser depth, but they have the faculty, and sometimes quit that situation; this is effected by contracting the foot, which then acts as a spring, and they are propelled forward. Their natural position is with the valves downwards when concealed in the sand, and they then move forward by slow degrees, in which operation the foot acts as a lever to assist their march. Under the respective names of the genera composing this family, the particular description of each species will be found.

CONCHOLEPAS (Lamarck); **PATELLA LEPAS** (Linnæus). By many naturalists, this singular shell has been considered a *Patella*, with which it was classed by Linnæus, from which it is most widely different, by many characteristics, and particularly by two distinctions, that of having a spire and being an operculated shell. This error may, in some degree, be accounted for, by supposing that great man had only examined an injured specimen of the shell, in which the extremely small spire had been worn off, that being frequently the case, the shell being generally much wormed; and, as he paid little or no attention to the animals of shells, the operculum, no doubt, was never seen by him. Brugnière, observing the spire, classed this shell with the *Buccina*, a far more natural association: this he did also on account of the slight notch at the base; but Sowerby has yet more properly considered it allied to the *Purpura*. From these consider-

able doubts exist in our mind of the propriety of separating them. Lamarck classed this genus immediately following that of *Monoceros*, from having two teeth at the base of the right side instead of one; but what he termed teeth, are no more than the continuation of two external thickened ribs, which, being flattened and broad, in no respect resemble the tooth of the *Monoceros*, which is a distinct sharp-pointed, round, slightly convex point, and very differently situated with regard to its position on the shell. Lamarck's description of the shell is:—shell oval, inflated, half spiral, the summit inclined obliquely on the left side, columella flat, aperture very ample, oblique, longitudinal, and with a slight notch at the base; *two teeth* at the lower part of the right margin. To this we must add some other striking and constant characters. The small spire is formed of three whorls, the apex pointed; it is nearly concealed by the very widely expanded aperture, the left side of which is greatly reflected, and forms a sharp angle above it; the right lip crenated at the base; the exterior presents transverse grooves, or slightly formed ribs diverging from the apex to the margin, and imbricated with small scales and a horny operculum very closely resembling that of the *Buccinum* or *Purpura*. We conclude the animal to be altogether unknown, not having met with any description of it. Of this singular genus the only species known is from the coast of Peru, and is here figured. In beauty, this shell has little



Concholepas Peruvianus,

to recommend it, but, to the conchologist, it presents much interest, as it is one of the well-defined instances of the links of connexion existing throughout the classes and genera of shells; it illustrates that system of gradation which, sooner or later, will complete one general chain, and explain many phenomena, well grounded in theory, but badly accounted for by examples. In the system of De Blainville, this genus is placed in the second class *Paracephalophora*; first order *Siphonobranchiata*; second family *Entomostomata*—it immediately follows the genus *Purpura*, and precedes the genus *Strombus*, but it is not unlikely that it will ultimately form a division of the first, from which we consider its separation as only temporary.

CONCHOLOGY. Under this title, or that of **TESTACEOLOGY**, naturalists have hitherto comprehended a systematic arrangement of shells, whether marine, fluviatile, or terrestrial: it is the science by means of which that branch of natural history is distributed into genera and species. The title conchology has, however, been somewhat misapplied, having been used in a less extended sense than its etymological meaning implies; since conchylium does not express a shell only, but the molluscous animal, whose body is altogether protected—merely partially covered

with a shell, or possessing portions of shelly matter, concealed under its skin, or in its folds, to defend certain organs most liable to external injury from their exposed situation. Such of our earlier naturalists as merely studied an arrangement of shells, detached from their parent architect (as was, in fact, the case with nearly all of them), have in many cases, and should in every one, have designated their systems by the term *Testaceology*, which is more appropriate, as not admitting any perversion of the meaning they attached to it, and clearly expressing its derivation and object—*Testa*, the Latin word for a shell; and *Logos*, a Greek word, meaning a discourse or treatise on the subject to which that word is added when descriptive of a science. The Greek writers on natural history also used the term *Ostracology*, which has the same meaning, and is considered by many authors far preferable, not being a compound of two languages, a fault but too frequently observable in the terminology of all works on natural history. Until within about the last half century, nearly every author on this branch of nature has written exclusively on the arrangement of shells, detached from the animals inhabiting and constructing them; this, with very little exception, continued down to the period when the immortal Linnæus, who may be styled the father of systems, among others, formed one of Conchology, but, like his predecessors, it was based entirely on the form of the shell, and his genera composed from the characters it presented. This was done with considerable judgment, and many of his descriptions are extremely accurate, so far as regards external configuration, but in theory, this system is wholly artificial, and consequently bad. It is true he seems to have felt it so to a certain extent, since he has made some reference to the analogous animal which he imagined to have belonged to the shell; these he placed amongst his *Zoophytes*, but he still took no other guide than the form of the shell, and made but few inquiries with respect to the supposed inhabitant. The impulse given throughout Europe by his system, and that of several other eminent naturalists, led to an extended view of the subject; their attention became drawn to the anatomical investigation of the animals themselves; and the subject presented an interest never before experienced; accounts were published of the result of these inquiries, gradually producing a different method of viewing the classification of molluscous animals; and Pallas may be considered the head of this new school, as, in fact, it was from his *Miscellanea Zoologica* that the first germ of improvement was derived in the arrangement of shells, since grown into its present form, though as yet, in many respects, only in its infancy.

Before this, all the systems descriptive of testaceology, were as imperfect as an arrangement of the feathers of birds would have been in ornithology, or the scales of fishes in ichthyology, were writers on these objects of the creation to have confined themselves alone to a systematic arrangement of those parts, without a reference to the animals of which they are merely necessary portions. Cuvier, that great master of nature, feeling the importance of the subject and the want of such an arrangement, directed the vast resources of his giant mind to the accomplishment of the only conclusive classification that can be formed; he improved upon the hints thrown out by previous naturalists; surmounted the difficulties they could not overcome, and was the first to complete a

general systematic classification of shells, built upon an investigation of the animals themselves, in which the families were ranked according to their structure and habit, as far as they were known, or could be safely decided upon by analogous reasoning. Thus, by taking nature as his guide, he has created a system that will stand the test of time as being the most natural, and consequently the best that can be followed. Like every human effort it has its errors, but they are fewer in number, and more those of observation than of theory. Prior to this period little more had been effected than to point out a tolerably lucid arrangement of shells themselves, without any other guide than that of the external configuration they presented, a system perpetually subject to error, because it is not natural, and one which has occasioned the innumerable inconsistencies of Linnæus.

There is no one at all an observer of natural history but will confess, that the apparent freaks of nature, in her productions, are so unaccountable, particularly in conchology, that they never can be depended upon as secure indications, when unsupported by a knowledge of their causes. This can only be acquired by a careful and repeated examination of the animals constructing the shells, and who form their habitations after such a fashion as is best adapted to their wants and security. Nature never oversteps the bounds which the necessary conditions of existence prescribe to her; but, when she is unconfined by these conditions, she displays all her fertility and variety, never, however, departing from the smallest number of combinations that are possible in the essential modifications, though apparently sporting with infinite caprice in all the accessory parts. In these there seems no necessity for a particular form or disposition; it even frequently happens that peculiar forms are created without any self-evident utility. It seems sufficient that they should be possible, that is to say, that they do not destroy the harmony of the whole; in proportion, therefore, as we turn our attention from the important organs of animals, to those whose functions are less so, we discover increasing variations. But when we arrive at the surface of the body, as in shells, where the nature of things requires that the parts least essential, and the injury of which is least dangerous, should be placed, it becomes so considerable, that all the labours of naturalists have not yet been able to give us an account of them. Among these numerous combinations, there are necessarily many which have common parts, and there is always a certain number which exhibit very few differences. By the comparison, therefore, of those which resemble each other, we may establish a kind of series, which will appear to descend gradually from a primitive type; a consideration of these have formed the foundation of the ideas some naturalists entertain of a scale of Being; the object of which is to exhibit the whole in one series, commencing with the most perfect, and terminating with the most simple kind of organisation, or that which possesses the least numerous and most common properties, so that the mind passes from one link of the chain to the other, almost without perceiving any interval, and, as it were, by insensible shades. These observations may generally apply to the study of natural history in all its branches, and is particularly evinced in the classification of shells adopted by modern naturalists, from the structure and organisation of their inhabitants: it constitutes that striking advance in the science,

which distinguishes it from the Linnæan school, in which a knowledge of the animal was not at all studied. In the present state of zoology, the shell and its architect must be coupled together, and Conchology, as it was formerly understood, can no longer, with propriety, express the system it now embraces, and which the French naturalists expressively call *Malacology*, a term meaning *a treatise on soft animals*—a title so satisfactory that we cannot do better than adopt it. Under the article MOLLUSCA, we shall more fully explain the principles of the system, at present we will confine ourselves principally to Conchology, in the light it has hitherto been viewed—that of a description of testaceous bodies. It may be well here to observe, that we have indiscriminately used the word mollusc as applied to shells as well as to their inhabitants, throughout all the articles in this work, treating of that branch of natural history. In this we are sanctioned by the authority of several eminent English naturalists.

To persons who are collecting shells and forming cabinets of them only as beautiful objects of creation, the system of Linnæus may answer as well as any other, since they feel no interest in the scientific arrangement of the species, or those wonderful progressions which mark the connecting links of genera, families and species with each other, changes frequently only to be accounted for by an adaptation of parts to necessity. Indeed, were it possible to preserve the animals who have formed the various species, they would present no attraction to the eye, nor add any value to the shells that contained them; but the impossibility of doing this renders the researches and reasoning of naturalists the more valuable. It may, indeed, to mere collectors of shells, appear wholly uninteresting, but a moment's reflection would convince them, that when we attempt to raise a part of the mysterious veil thrown over the works of nature, in order to acquire some knowledge of her laws, we then derive a new satisfaction in contemplating their operations; so that without being ourselves either anatomists, physiologists, or naturalists, in an extended sense of their meaning, we cannot fail of having our attention roused to examine many facts, extremely curious in themselves, which the *shell alone* exhibits, and the mind, once excited into action, seldom rests until it is satisfied. By pursuing a subject to its utmost limit, generally speaking too, the more difficult the task becomes, the more ambitious we are to surmount it. The mind may, indeed, for a time, flag and feel fatigued by over exertion, but such are its elastic faculties, that they may be deemed indefinitely expandible; to say at what point knowledge will stop is utterly impossible, we must not, therefore, reject as useless such portions of it as we cannot immediately understand, but relying on others more advanced than ourselves, endeavour, by every possible exertion, either to corroborate their assertions by our own observation, or, by following the guide given us, to pursue the inquiry still farther. In this point of view, surely the amateur of shells must desire to have his collection arranged according to something like a natural system, and we cannot too frequently impress on the young naturalist's mind, the necessity of observing most attentively the indications so often furnished by nature, many of which are very generally overlooked, and altogether despised as useless, from their being but slightly defined: these are, nevertheless, the natural indices to much

information, and though not in every instance conclusive in themselves, may always be deemed the safest and best guides we can follow in pursuing an unknown tract of inquiry, to which the main road is concealed, or not generally attainable.

The modern systems of Cuvier, Lamarck, and other naturalists of that school, embracing, as we have stated, a knowledge of the animal as the foundation for the classification of its covering, have by many been found fault with on account of the multiplication of genera, which appears to them unnecessary and difficult to comprehend; but such in fact is not the case: on the contrary, the study of testaceology is greatly simplified, and the learner's progress considerably facilitated by confining within a narrower compass the too widely-extended genera of Linnæus, and re-modelling those he had blended together in the most confused manner, whether with regard to the form of the shell and its habitat, or the functions and structure of the animal, a reference to which he merely glanced at. By the information now obtained, from an anatomical investigation of these singular creatures, we are enabled to distinguish between them by certain more or less strongly marked generic characters peculiar to each, and to place their dwellings in a natural series of classes to which this knowledge can alone conduct us. If it be said that the increased number of genera obliges the student to charge his memory with a greater number of sometimes hard names, it cannot much signify, since a knowledge of the whole catalogue can only be acquired progressively. To the disciples of the Linnæan school, the argument still less applies, since they have only to add the newly-constituted genera to those they already know, all of which have been retained by modern writers, only, as before remarked, more naturally distributed, as will be shown under the article MOLLUSCA, in which a comparative view of the two schools, and the changes that have taken place, with the reasons for so doing, will be more fully, and, we trust, satisfactorily explained.

We will also here observe, that we have, in some degree, deviated from the beaten path of an alphabetical publication, by including in this article much matter that might more properly be deemed referrible to the article SHELL. We have done so in order to render the subject more comprehensive and more readily understood by many of our readers, who doubtless have much to learn before they can derive any pleasure or sound instruction from the study of this branch of natural history in a systematic form. A considerable time must elapse before the article SHELL can make its appearance, though various matters relative to it are continually given under their particular head in our alphabetical arrangement; and to those who have not made Conchology their study, many terms technically used to explain portions of the subject, would be incomprehensible, and the science rendered doubly difficult to understand; but by now including a glossary of many terms, established by modern naturalists in the description of parts of shells, their relative position, and their connection with each other,—some account of their growth and distribution in nature,—a rapid view of the history of Testaceology, as we here continue to call it, down to the period when the necessary corrections of the Linnæan system required that change of classification which includes the animals with the shells, the science became more properly designated Malacology,—we

think the student's progress will be much facilitated; he will advance, as it were, imperceptibly in the study of this interesting pursuit, till he arrives at, and is capable of understanding the subject in its embodied form of a system. The imperfection of an alphabetical arrangement in publications like the present one will thus be partially obviated, and the tributary information, in a great measure acquired prior to its being consolidated into one mass.

Systems were formed for masters, not for the scholar; for what student would have courage, in the first instance, to wade through a ponderous tome, each page teeming with unutterable terms, to expound which would require the concentrated learning of a polyglot dictionary, and if ever puzzled out, would, many of them (not to say most of them), be found to have but little reference to the thing in question—to give no descriptive assistance, but to have been coined from the author's caprice or particular view of the object before him. Let us not, however, be understood as finding fault with the necessary scientific nomenclatures established by long usage: did they not exist, it is obvious that the simplest object could not be explained without great circumlocution; neither can we object to their being expressed in the most universal language known—the Latin tongue, since a knowledge of that opens the high road of mental communication with all the civilised nations of the world, enabling scientific men to converse and interchange their ideas or opinions, though living distant as the poles asunder. But we do seriously deprecate the affectation some authors exhibit of displaying unnecessary erudition in their nomenclature—of applying profound learning to trifling objects, and, what is worse than all, of giving names and terms that have no reference whatever to the subject matter; this needlessly embarrasses the student, by leading him far out of his road, and a name which should assist him like a sign-post on his way, pointing out the shortest path to some other place of inquiry, becomes his greatest impediment—of no use whatever, if not understood, and if comprehended, is perhaps not at all explanatory of the subject. An opposite species of affectation has been recommended by some modern writers in this country, that of anglicising all terms of science. But it is quite impossible so to simplify scientific study, as to do without a generally-received nomenclature in some language or other, and, as we have just observed, the Latin, from its universality, is the best of all others; but let every newly-coined term be strictly confined to its plainest expression, and its meaning always explanatory of the object to which it is applied: without this is attended to, it is “fighting flies with spears.” A system is a completion of the whole subject, and can no more be properly understood at first sight than a watch or any other complicated piece of machinery depending upon its subordinate parts for the production of one perfect result; it must be studied step by step, and the more easy the path is rendered by removing difficulties, the more inviting the progress will become. Cuvier observes, “that the formation of systems is the object of natural history, properly so called. Anatomy receives them as it were ready made. The latter takes its first direction from the former, but it is not slow in reflecting back the light it has received. By applying a system of natural history to comparative anatomy, we are speedily enabled to discover whether it deviates from the path of nature. The object of every good method

is to reduce a science to its simplest terms, by reducing the propositions to the greatest degree of generality of which they are susceptible. A good method must therefore be such as will enable us to assign to each class, and to each of its sub-divisions, some qualities common to the greater portion of the organs. This object is to be attained by two different means, which may serve to prove or verify one another. The first, and that to which all men will naturally have recourse, is to proceed from the observation of species to uniting them in genera, and to collecting them into a superior order, according as we find ourselves conducted to that classification, by an examination of the whole of their attributes. The second, and that which the greater part of modern naturalists have employed, is to fix beforehand upon certain bases of division, agreeably to which beings, when observed, are arranged in their proper places. The first mode cannot mislead us, but it is applicable only to those beings of which we have a perfect knowledge; the second is more generally practised, but it is subject to error. When the bases that have been adopted remain consistent with the combinations which observation discovers, and when the same foundations are again pointed out by the results deduced from observation, the two means are then in unison, and we may be certain that the method is good.”

Many whom we unhesitatingly call ignorant persons, not knowing the benefit mankind has derived, and must yet reap, from the study of natural objects, overlook totally, or but lightly value the wearisome preliminary steps—the never-ceasing patient investigation by which these advantages have been acquired, this knowledge gained. Such persons have considered Conchology particularly, as undeserving the rank of a science, its study beneath the serious attention of a highly-cultivated mind, and affording nothing beyond the gratification attendant on the possession of pleasing objects to the eye, or to that vanity which frequently springs from the exhibition of an elegant and costly taste, not attainable by our less fortunate neighbour. To them let it be said, that the contemplation of objects created by Him whose beneficent wisdom caused all these things to be; of Him who has formed nothing in vain; of Him who in “six days made the heaven and earth, the sea, and all that in them is,” cannot either be useless or beneath the dignity of the most enlightened man, the utmost extent of whose education can only teach him how little he can ever know of all that is yet to be learned. In natural history especially, we are always to a great extent dissatisfied with whatever we perform, for nature proves to us at every step that she is inexhaustible; but this, nevertheless, augments our enjoyment, as we proceed onward in our pleasing task—as each difficulty is surmounted, a new impulse is given to our exertions, till we are ultimately rewarded by being able to read the book of nature in its proper language. Happily, the researches and writings of some few scientific men have of late years given a zest to the study of natural history never before experienced, by clothing it in the simple language of truth, enabling us, while cozily placed by our fire-sides, to wander in imagination through the scenes they so glowingly describe. We live for a time in every country; in every clime, we seem to travel along with them in their sometimes perilous journey, to share their dangers, and to participate in the satisfaction of having surmounted them. Who can read works like those of Audubon, Water-

ton, Wilson, and many others, without feeling all this, and much more? And though some twinges remind us that years have rolled their weight upon us since we brushed the morning dew, we are nevertheless carried back to the halcyon days of youth, when, as we bounded through the daisied mead, all nature seemed decked in never-fading beauty, by such writers, the rich, the marvellous storehouse of nature is opened, her treasures displayed to our eager view, and from "nature we look up to nature's God." It has been gravely asserted, that wretched beings have existed, called Atheists, and that the investigation of nature's works has led to infidelity in some persons. We doubt the existence of the one, and utterly deny the possibility of the other; but should such a species of frenzy for a moment obscure the light of reason, paradoxical as it may appear, we fearlessly prescribe, as the only certain cure, the very supposed cause of the malady; and say, let the sufferer apply himself fearlessly to the study of natural history, in all or any portion of its branches, believing, as we most conscientiously do, that a good naturalist can never be a bad man. Conchology, it must be confessed, does not, unfortunately, present all those inviting charms in its study that the other portions of the creation do. We cannot become intimately acquainted with the habits and manners of creatures inhabiting the profound depths of the ocean, in which the works of nature, generally speaking, are more known by accident than any other source of information; where, too, no regular train of reasoning, from an observation of these animals in their native element, can be pursued, beyond that afforded by an examination under the most unfavourable circumstances, of a very small portion of the teeming myriads that exist unseen; and until the endless ingenuity of man shall have invented some sub-marine mode of conveyance—some omnibus, that will transport us safely and speedily to the nethermost pole and back again, enabling us to travel in "that world that lies below the now smooth and glassy surface of the deep, and the now wild and tremendous action of its waters, to contemplate the varied forms, qualities, and habits of its animated tenants, their subjection to man, and their subserviency to his use," or to realise the poet's dream, by beholding those scenes—where

The floor is of sand; like the mountain drift,
And the pearl shells spangle the flinty snow;
From coral rocks the sea-plants lift
The boughs, where the tides and billows flow;
The water is calm, and still below,
For the winds and waves are absent there;
And the sands are bright as the stars that glow
In the motionless fields of upper air;
There, with its waving leaf of green,
The sea-flag streams through the silent water,
And the crimson leaf of the dulse is seen
To blush, like a banner bathed in slaughter;
There, with a light and easy motion,
The fan coral sweeps thro' the clear deep sea;
And the yellow and scarlet tufts of ocean
Are bending like corn on the upland lea,
And life, in rare and beautiful forms,
Is sporting amid those towers of stone,
And is safe when the wrathful spirit of storms
Has made the top of the waves his own;
And when the ship from his fury flies,
Where the myriad voices of ocean roar,
When the wind-god frowns in the murky skies,
And demons are waiting the wretch on shore,
Then far below, in the peaceful sea,
The purple mullet and the gold fish rove,
Where the waters murmur tranquilly
Through the bending twigs in the coral grove.

PERCIVAL.

Till all this can be witnessed personally with as much ease as we can depict them mentally, our pro-

gress in acquiring a perfect knowledge of this science, in its extended sense, will necessarily be extremely slow and uncertain. We must depend principally, if not altogether, on the information derived from authentic sources. This we should confirm by every possible opportunity, neglecting nothing likely to assist our doing so, however insignificant it may at first sight appear. More is really learned by the application of common sense, though only to a limited extent, than all the systems written could impart to *beginners* in the study of natural history; for, by actively exercising our reasoning faculties, we determine, upon the strongest grounds of rational deduction, many facts but slightly defined, or wholly invisible.

We have not, most of us, the opportunity of examining with our own eyes some of the molluscous animals that are within the reach of other persons, many of whom, unfortunately, know not how to benefit from the opportunity; we are therefore compelled, in numberless instances, to take for granted every traveller's tale, until the truth or fallacy of it is confirmed by subsequent information; but so inherent is the vice of fiction, that very little reliance can be placed upon many of the strange sights they see. Mankind is also so fond of novelty, or whatever partakes of the marvellous, that the every-day's observation of nature's operations is neglected; we are even too indolent to examine and reason for ourselves; we prefer gleaning imperfect ideas from fanciful accounts of nature, in our closet, to the delight of perusing her works in the rich volume every field opens to us. This obviously leads to the erroneous conclusions entertained by book-naturalists and book-makers, among which are some (and those, too, professing to instruct the rising generation) who have recently published a poetical description of certain shells sailing together in little fleets—one valve expanded to catch the passing breeze that wafts them o'er the unruffled bosom of the vasty deep—of others that may be supposed to pass their leisure moments in playing at leap-frog with each other. But these, like all other tales conjured up by the magic wand of fancy, are more entertaining than true, and must be condemned in works whose object should be to clothe facts in the simplest garb, divesting them of the tinselled ornaments of fiction, which, though they may dazzle for a time, shortly sink before the light of truth, and are rejected as worthless. Another serious evil arises from these pretty nursery tales, that of casting a doubt upon every other assertion, however well founded in truth.

An instance may here be adduced of the ease with which some of the interesting operations of nature can be witnessed in the portion of creation now under our consideration, and amply repay us for the trouble. It is afforded by the humble, persecuted, but most beautiful of our native molluscs, the snail (*Helix nemoralis*), the little creature we barbarously crush beneath our feet, considering it a common enemy to horticulture. When we examine its wonderful formation, its tenacity of life, its reproductive powers, an instructive lesson may be furnished to the conchological student, most satisfactorily explaining the growth of the vast proportion of similarly constructed shells in other genera, and enabling him to understand by actual observation, and the evidence of his own reason, some of nature's steps in this branch of her works; he may easily watch the various changes that take place from the slight viscous covering with

which the animal's body, in the first instance, is coated, or, as it were, merely glazed, till that substance becomes a consistent firm shell, finally fashioned into a painted palace adapted to the form and use of its inhabitant. It needs no logic to prove, that wherever creatures are endowed with a long endurance of life and great reproductive powers, great purposes are assigned to them. The contemned snail does not, therefore, merit the ill treatment it constantly experiences from man; and if we for a moment reflect upon its good services, and overlook its bad ones, we are bound to confess the former greatly outweigh the latter. It is viewed as a destructive marauder in our trim gardens; but we forget that we have invited its inroads by placing, within a comparatively limited space, a choice selection of dainty food even to the pampered appetite of man, but altogether irresistible to a snail. In the open fields, or the widely expanded forest, this little creature performs useful purposes in conformity to the ends of its creation; one of the most important of which is that of assisting in consuming the exuberant productions of nature, which, without its operations, would encumber the surface of the globe, check the progress of future vegetation, and interrupt that perpetual harmony of system, which has wisely ordained that the extinction of life shall not be felt, but its devastations become supplied by succeeding generations, each of their kind, whether vegetable or animal. In countries where vegetation is too luxuriant to be trained by art to the use of mankind, covering immense tracts of land with impenetrable gloom, not only snails, but other species of terrestrial molluscs, achatina, bulinas, &c., are found, some of a very large size, proportioned to the magnitude of the duties they have to perform, and in these situations their voracity is said to be most extraordinary—stripping the loftiest trees of their verdure in an incredibly short space of time. Shall we then grudge it a slender portion of our superfluous luxury, without ascertaining, by actual examination and rational reflection, that this little creature was not merely ordained to devour our choicest fruit, but that it has also a duty to perform by consuming, in a far greater proportion, other things in the vegetable world that would, without them, prevent the full completion of the very object for which we ignorantly destroy a principal agent. The well-established fact, that the eggs of these animals have been absolutely baked, during six months, under the scorching rays of a tropical sun, without destroying the germ of life, proves, could no other facts be adduced, that nature has vested in these creatures certain important uses and powers far beyond our short-sighted views; and it must lead a philosophical mind to conclude, that in this instance, as well as in many others equally remarkable, we stubbornly close our eyes to the good that is forced upon us. We think we hear it said, that in advocating the cause of snails, we have never had the mortification of seeing our ripe and delicately-painted peaches disfigured by their hungry propensities. Be that as it may, we have also observed, that they, like ourselves, when no such treat presented itself, were content with humbler fare, and as industriously as voraciously consumed other objects, to us useless, or noxious as food, never deserting the purpose of their existence, though that end is not yet fully revealed to us. As an article of food, they are entitled to our consideration; for, though they form no part of our gastro-

nomie delicacies, they nevertheless were considered such by the Roman gourmand; see AMPULLARIA; and even down to the present day, snails form an important article of nourishment and commerce in Germany, France, Spain, Italy, Turkey, and the Levant. This digression leads to a conclusion, constantly to be drawn by every reflective mind, that from the colossus of bivalves (the *Tridacna gigantea*) whose inhabitant would satiate the "sharp-set appetites of an hundred men," down to the shell less than a grain of sand, each is endowed with similar mechanical powers and bodily faculties, adapted to its sphere of action in the place it is destined to occupy, the one and the other playing an equally important part in this crumbling theatre of mortality, and forming so many connecting links of the chain that binds together the invisible operations of nature under the directing wisdom of Omnipotence.

We hope to be able to point out many useful, as well as pleasing results, derived from the study of Conchology, and to give an interest to it beyond the commonly-received opinion of it. In the first place, it is inseparably connected with geology, or the formation of the earth, and a study of the one must necessarily contribute to a more perfect knowledge of the other, since shells, from a period before time was, have constituted so large a portion of the earth's matter. In their fossil state they have been eloquently called by a late writer the only *true medals* of creation now extant. He says, "by these medals we are taught that innumerable beings have lived, of which not one of the same kind does any longer exist; that immense beds, composed of the spoils of these animals, extending for miles under ground, are met with in many parts of the globe; that enormous chains of mountains, which seem to load the surface of the earth, are as vast monuments, in which these remains of former ages are entombed; that though lying thus crushed together in a rude and confused mass, they are hourly suffering those changes by which, after thousands of years, they become the chief constituent parts of gems, the limestone which forms the cottage of the lowly peasant, or the marble which adorns the splendid palace of the prince." To this may be added, that the local indications they furnish enable us to ascertain, with a considerable degree of precision, the identity or the superposition of the different strata of the earth's formation, to distinguish between the various geological changes of the antediluvian world, and to account philosophically for many of those natural phenomena which the mutations of this planet have produced, changes which, without some knowledge of conchology, must have remained, if not altogether unaccounted for, at least less easily understood. Indeed, it is to geologists that we are indebted, in a great measure, for having rescued conchology from the obscurity into which it had nearly fallen as a science. The extremely minute characters existing between fossil shells, or between them and recent species, required an extended knowledge of the subject, including the structure of the animal, as well as its dwelling; and it consequently became necessary to establish something like well-grounded principles and given rules to guide them in their delicate researches, or to assist in resolving the extremely difficult problems they have undertaken to explain. To the physiologist and anatomist, a study of the animals, the architects as well as inhabitants of these beautiful productions of

nature, presents an interest beyond the mere scale of enjoyment which a contemplation of them enlarges. It leads him, by analogous reasoning in comparative anatomy, the more clearly to understand some of the laws and economy of animal life, and to account for many of those paradoxical causes of vital existence which these inferiorly organised creatures illustrate.

Of the benefits derived by mankind from shells, or rather their animals, less is probably known at this moment than could be wished, or might be expected; they will only be developed by time. As articles of food, numberless species are well known. We need scarcely mention the oyster, for which our native shores have so long been famous; since, so far back as the beginning of the second century, the Roman poet Juvenal, while satirising the epicure Montanus, thus speaks of them:—

“He, whether Circe’s rock his oysters bore,
Or Lucrine lake, or distant Richboro’s shore,
Knew at first taste.”

These, with muscles, cockles, scallops, &c., form a considerable branch of commerce and wealth to the enterprising fisherman; an account of which will be amply given in the alphabetical arrangement. Many other species of shell-fish might also be enumerated, affording an agreeable and nutritive food to nations compelled by local situation, congenial climate, or ignorance of civilised improvement, to seek from ocean’s bounteous store, a natural and never-failing source of subsistence, frequently, indeed, the principal, if not the only one within their reach. In the days of Roman epicurism we have already enumerated snails and oysters, to these may be added *Echini* and *Balani*, for we are told, that at the famous supper given by Lentulus when he was made Flamen Martialis, or Priest of Mars, these and other shell-fish formed a part of the delicacies presented to the guests; and Pennant satirically observes, they seemed to have been eaten by the holy personages, priests and vestals, invited on the occasion, as a *whet* for the second course. The *Echinus*, however, is a crustaceous and not a testaceous mollusc, as we shall explain under its description: we have tasted both this and the *Barnacle*, but not possessing Roman stomachs, or perhaps from the want of classical cooks, we confess they appeared anything but eatable to our vulgar taste. As baits to catch fish, many species of shells are used; we have, ourselves, captured many a bright mackerel and whiting with no other lure than a small piece of mother-o’-pearl suspended from the hook. The amphibious mammalia, sea-birds, and even many fishes, derive a large portion of their sustenance from shell fish, which tends to check, without destroying altogether, the innumerable broods hourly brought into existence. Except as food, shell-fish contribute but little to supply the other wants of mankind. The *Pinna marina* does, it is true, furnish with its byssus, or beard as it is commonly called, a silky filament, in sufficient abundance to be fabricated into gloves, stockings, and some few other articles of wearing apparel, but not in such quantities as to render them articles of general use, or commercial speculation, beyond the value attached to them as museum rarities. The *Janthina*, *Buccinum*, and other shells, indicate the presence of a strong colouring matter, and a species of *Purpura* produced the highly valued Tyrian purple dye, which formed a very costly article in the catalogue of Roman

extravagance; but the same colour being now obtained by the chemical effects of mineral or vegetable matter, at a trifling expense, has, of course, superseded its use. In early treatises on medicine, shells ranked as useful agents; they, however, now form no part of the pharmacopœia, common chalk being equally efficacious. In countries where the manufacture of glass is either unknown or too expensive to be generally used, a shell of the genus *Placuna* is substituted to the present day, its extremely thin valves permitting the rays of light to pass partially through them. With these, in China and Japan, the windows may be said to be glazed. As a commercial circulating medium, shells have been employed on the coast of Africa, where sealed bags of the *Cyprea moneta* (money cowry) form tallies for certain sums; thus exchanging hands in the trading operations of uncivilised nations, as an equivalent for coin, and redeemable by the party issuing them with the same good faith that notes are honoured by the firm on which they are drawn. As articles of luxury and decoration, shells, from the most remote period of history, have afforded personal ornaments, in various ways, to civilised and savage people. With some they are distinctive marks of rank, and in the idolatrous worship of India, some species are consecrated to ignorant superstition, by those “who sit in darkness and who see no light.” The *Avicula margaritifera*, commonly called the mother-of-pearl oyster, is universally well known as yielding that beautiful iridescent substance, from which numberless elegant and useful trinkets are fashioned by skilful workmen. It must be observed, however, that the beautiful colours, like those of the *Opal*, which they resemble, are not the effect of any pigment or colouring matter, but occasioned by the mechanical arrangement of the molecules, or atoms of matter, constituting the lamellar substance of the shell, being so distributed as to become capable of decomposing the rays of light, and reflecting the exquisite prismatic hues which all pearly or nacreous shells exhibit. On this subject the philosophical experiments of Brewster and others are highly interesting. It is the animal of this shell, or a diseased condition of it, which produces that modest but highly coveted jewel, the Oriental pearl, the pride of Europe’s fairest daughters, or Afrie’s sable children—the gem that decks a monarchs brow, or graces native innocence. In sacred writing, pearls are frequently named as things of inestimable value. “No mention shall be made of coral or of pearls, for the price of wisdom is above rubies;” and in Matthew, our Saviour said, “The kingdom of heaven is like a merchantman seeking goodly pearls, who, when he had found one pearl of great price, went and sold all he had and bought it.” Poets of every nation, but particularly those of the eastern nations, have compared the objects of their dearest affections to pearls, as the most invaluable things known, its Persian name *Mervarid*, or globe of light, being constantly used in the hyperbolic language of oriental poetry. Our native poets have also frequently alluded to pearls; upon the latin name of which (*Margarita*), Drummond, in his poems, 1656, classically puns in the following lines—

In shells and gold, pearles are not kept alone,
A Margaret here lies beneath a stone;
A Margaret that did excell in worthe,
All those bright gems the Indies dothe send forthe.

Several other species of shells, both marine and

fresh water, also produce pearls—the *Pinna marina*, *Tridacna gigas*, *Unio*, *Mussel*, &c.; they are, however, far inferior in beauty and value, though Suetonius informs us that the pearls found in Britain were so highly extolled at Rome, that they mainly influenced Cæsar's invasion of our sea-girt isle, and though his ambitious views were only in part realised by the attempt, he did not lose sight of one of the inducements which led to it, and a buckler, richly decorated with British pearls, was placed on his return, in the gorgeous temple dedicated to Venus Genetrix, as a trophy of his mad ambition, and an imperial offering worthy the sea-born goddess. The rivers and seas of Ireland, Wales, and Scotland still yield pearls; even to a late date fisheries of them have been established, but the produce is comparatively of so little value that it no longer repays the speculator. A remarkably fine Welsh pearl is said to have been presented by Sir Richard Wynne, of Gwyder, to Catharine, Queen of Charles II., and still to hold its place in the regal crown of England.

In the alphabetical arrangement of this work, pearls will be more amply described, and an account of the Oriental pearl fisheries given.

Having enumerated some of the known benefits mankind derive from shells, whether as food, ornament, or otherwise, it will be proper to point out such as are injurious, or so considered in certain points of view, that is, so far as their habits tend to defeat the industry or ingenuity of man; but here, as in the instance of the common snail, we feel called upon to enter a philosophical protest against treating them indiscriminately as destructives and enemies. The evil they commit is certainly manifest, but it is confined to a very limited circle—it may be everywhere checked, or prevented by care or art—while the good they perform, being unseen and extended over an immense space, passes unheeded, and, in the present stage of our knowledge of natural history, is not appreciated as it should be; let it, however, be remembered, that there is an eternal fitness of things which requires that the decrease of various portions of creation should, in some degree, keep pace with their otherwise superabundant growth, thus balancing the account of nature's dealings, and regulating the expense of life. Extensive mischief is doubtless committed by that insidious little animal the *Teredo*, which recklessly wends its way in ten thousand tortuous paths, through the hardest oak, or toughest teak, rendering them like sponge, and destroying their texture as supports to submarine erections, occasioning, in certain localities, dangerous consequences; piles, jetties, piers, and vessels, long stationed in some climates, are subject to their ravages, from which fatal accidents have resulted. It is not in human nature thus to witness the destruction of the noblest works of our ingenuity, without condemning the agents that have effected it; but these are no more than additional illustrations of the fact, that it is for man's ultimate benefit such occurrences should take place—they give a stimulus to his industry—set his wits to work—teach him to counteract the evil committed against his immediate interest or convenience, and often create a far greater eventual benefit than he could at first sight discover. The wise man only becomes so by not despising the humblest information, he is constantly examining, inquiring, or reasoning on everything around him; and some of the greatest efforts of genius have been perfected from the indica-

tions furnished from apparently trivial causes, overlooked at first from their insignificance. Another of the number of shells but little loved by mariners, is the *Balanus* or *Barnacle*, whose numerous broods spread themselves in thick congregations, sometimes as it were incrusting the bottoms of ships, and their sides below the water mark, to such an extent, that her progress through the pathless sea becomes seriously impeded: the watchful sailor baffled in his best exertions, and the wealthy speculator disappointed in his nicely calculated hope of gain. To conclude our list of commonly called destructives in conchology, we shall add the *Pholas*, and other of the penetrating genera of shells, whose habitations are formed in calcareous, and even stony matter, wood, &c., there performing either good or evil according to the particular circumstances of their situation and the purposes of their being, which are, if well considered, probably more beneficial than prejudicial to mankind.

Shells are abundantly distributed over every part of the globe, from the polar regions to the torrid and inter-tropical zones, increasing in number, size and colour, as they recede from the one and approximate the other, a fact equally to be observed in the other works of creation. Heat and light, as we shall hereafter explain, possess such a prodigious influence on these productions, that the most beautiful, whether marine or terrestrial, are those inhabiting tropical climates. It may be said, that no part of the world is divested of shells, either terrestrial, marine, or fluviatile, and the number of their species is always proportioned to the extent of their peculiar location or habitat; we may also ascertain that nearly all the families exist in the different zones of the globe, though the genera and species of some are far more numerous in one zone than in the other. To attempt a detailed account of the geographical localities of the different genera, would not only be extremely difficult, if not totally impracticable, but would occupy a larger space than can conveniently be allotted to the subject in a work like the present one; we will, nevertheless, point out a few leading facts with regard to the habitat of shells, which will serve as a general illustration of the localities of their congeners. In the high northern latitudes shells are not numerous, and the species most usually found are of the genera *Terebratula*, *Mya*, *Pandora*, and some of the *Solens*; they are not, however, equally abundant in all the northern seas. The *Ostrea*, *Avicula*, *Orbicula*, *Crania*, *Terebratula*, *Halotis*, *Pecten*, *Patella*, *Area*, *Lima*, *Mactra*, *Pholas*, *Balanus*, *Cardium*, *Teredo*, and *Helix*, are everywhere found in greater or smaller numbers, as the degree of latitude varies; the *Clavagella*, *Aspergillum*, and *Fistulana*, appear confined to the equatorial zones; the *Vulsella*, *Perna*, *Chama*, *Crenatula*, *Trigonia*, and some of the *Cardia*, inhabit the southern zones; the *Harpa*, *Terebra*, *Cassis*, *Pleurotoma*, *Mactra*, *Strombus*, *Conus*, *Oliva*, *Ovula*, *Cypræa*, &c., principally inhabit the inter-tropical regions; the *Tridacna* has not yet been met with anywhere than in the Indian archipelago; the *Argonauta*, *Nautilus*, and *Spirula*, mostly dwell in the torrid zone. With respect to terrestrial species of shells, it may be observed generally, that they are more numerous—higher coloured, and of a larger growth, in the southern and eastern regions, than in the northern and inter-tropical. Our *Helix nemoralis*, field snail, is, however, a remarkable exception, as its colours vie with those of its congeners in any other country, and

in point of size, some species of European *Helix* exceed those of the warmer latitudes ; the *Testacella* may be said to live almost underground ; and hot springs, and the bituminous waters of the Dead Sea, are not without testaceous inhabitants. Extremely interesting conclusions will, sooner or later, be drawn, as the science of malacology becomes better understood ; respecting the diminution of species, the limits of their variations, and to what extent the individuals are modified by local circumstances in the places they inhabit. Many shells are of a very large size, while others are invisible to the eye. In the formation and arrangement of collections of shells, merely as objects of natural beauty, they cede to no portion of nature's productions ; and, unlike every other branch, they possess this immense superiority, that with a very moderate degree of care, they may be preserved comparatively uninjured for centuries, losing nothing of their substance, and but little of their colour.

How truly the naturalist, Pliny, says—"What can be more wonderful than to view nature in all her irregularities and sports in her variety of shells ; such a difference of colour and of figure do they form, flat, concave, long, lunated, drawn round in a circle, the orbit cut in two ; some are seen with a rising on the back, some smooth, some wrinkled, toothed, striated, the point variously intorted, the mouth pointed like a dagger, folded back, bent inwards ! All these creatures, and many more, furnish at once novelty, elegance, and speculation. While I thus contemplated nature, she wrought in me a persuasion that I should look upon nothing as incredible that related to her." What, indeed, can surpass the freaks and vagaries exhibited by nature in this portion of the creation ? For, whether we admire the graceful symmetry of some, or the grotesque deformity of others, the delicate sculpture, or the rude furrows, the exquisite pencilling and vivid tints, or the bold marking and sombre hue of shells, we are lost in admiration, and the contemplative mind is roused to adore the infinite wisdom that has called all these creatures into existence, and the interest they excite induces us to attempt in some degree to account for their uses. Thus conchology is raised to a more important rank in the march of intellect than it has hitherto occupied in public estimation. We hourly begin to develop new features in its study leading to philosophical results never before contemplated ; and though our progress is so much restricted by circumstances, it will be rendered the more secure from being progressive, and founded upon repeated observation ; we are involuntarily led to assign causes for the effects, and some insight is gained into phenomena that at a first glance appeared most marvellous. Marvellous in truth they must always remain as regards the power and wisdom that gave them life, and invested them with given functions in the scheme of creation. It is, however, to their mechanical structure, if we may be allowed the expression, that our remark applies. In this the exercise of that most invaluable of all gifts, common sense, combined with the tolerably accurate observation of our visual organs, is all that is necessary to those who have not had the additional advantages of an education directed to the improvement of these observations upon anatomical data. This is, however, of the less importance in conchology, treating it, as we now do, as a separate science, and solely applicable to shells, in which point of view nine-tenths

of our readers will value it, if they value it at all ; but they must not forget that, as a science, it is most incomplete, imperfect, and artificial ; if the animals themselves are not to be studied in connexion with their coverings, for they ought not, and cannot properly be separated, without violating every principle of natural history, and rendering this branch no more than a classification of differently-shaped pieces of carbonate of lime.

It being demonstrable that shells are formed on the model or naked body of the animal constructing them, every portion or inequality of surface these bodies present must necessarily cause either depressions or protuberances on the exterior of their shells corresponding with them ; whereas, in the simple snail, these do not exist, or in other shells which have only little elevated knobs, or regular grooves, bands, &c., we easily may conceive how the surface of the shell corresponds with the exterior of the animal's body : and when we examine shells constructed like the *Scaloria pretiosa* (Wentletrap), or the *Harpa* (Harp), and others of a similar character, we observe the covering of an animal whose periodical increase is distinctly marked by the lip or termination of each addition to its original size. This forms what may, for the sake of description, be termed ribs, when placed longitudinally from the apex to the base, as in the *Harpa*, or rings, as in the *Scaloria* ; and here we only want the opportunity of ascertaining the time occupied in constructing each of these additional portions, to determine the age of the shell. This remark also applies both to bivalve and univalve shells. But when we examine a shell set with spines, or foliated processes, we for a moment hesitate to believe that such was formed in the animal's body ; and here the exercise of common sense is necessary to explain, in the absence of the animal, that which appears inconsistent with the theory laid down ; our reasoning faculties are called into action, and we observe, that in the early stage of growth, many species of shells differ widely from their mature formation, many instances of which may be named in the genera *Strombus*, *Pteroceras*, *Ranella*, *Cypræa*, &c., not to mention numerous bivalve shells whose valves are variously provided with spines, arched scales, &c. When such are met with, it is obvious that their formation has been caused by the necessity the animal feels of having certain corresponding organs protected, either wholly or partially. In the first period of growth, these organs, not having reached the full term of their development, the shelly matter extended no further than was required, for nature, in her operations, never squanders the materials she employs to carry them into effect ; she always adopts the shortest way of going to work, having no ulterior object to guide her course than necessity ; but that hard taskmaster never drives her from an uniform progress. Combined with the strictest economy both of time and matter, everything in creation hastens on, by regular stages, to its utmost state of perfection or maturity—there stops—ever after sinking into gradual decay. The purposes of its animal existence daily become more feeble, till they are altogether extinguished by death. Thus, in the genera we have just named, the claws, spiny processes, or terminal bands, could not have been formed from a calcareous deposit on the body of the animal, properly so called ; but we can easily account for their formation, particularly if we have the advantage of examining the young and the adult shell at

the same time. In the *Pteroceras*, here figured, for example, the young shell, instead of the elongated

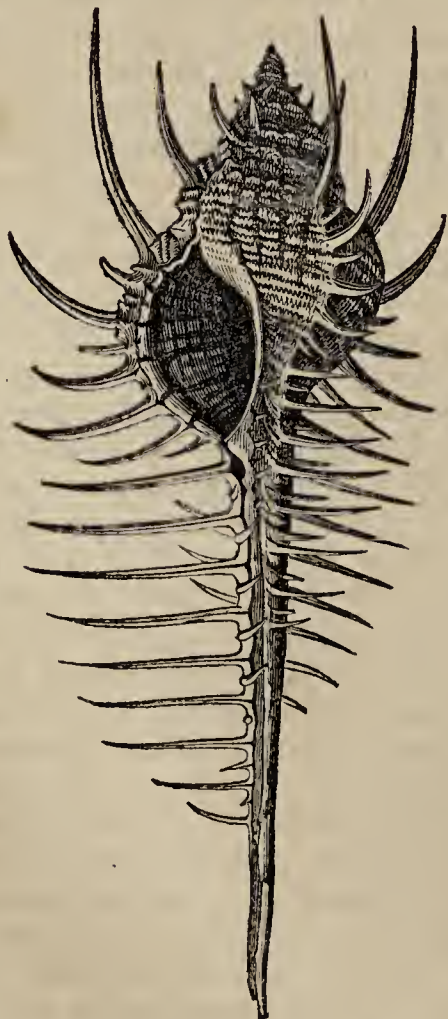
Young Shell.



Adult Shell.

PTEROCERAS SCORPIO.

points, has open, waved prolongations, which, as the organs they then covered increase in length, become lengthened, and finally closed altogether, as the animal, after attaining its maturity, finds it no longer necessary to go on building, but then retreats into its dwelling, and the very organs most serviceable to complete it not being any longer in constant action,



Murex tenuispina.

cease to grow, and, on the contrary, diminish in size, and very frequently disappear altogether. In other

genera, the *Murex*, &c., we see regularly-formed sets of spines, or foliations, at given intervals, round the spiral form of the shell. Each of these, it is quite clear, formed previous terminations, and became successively closed as the increased size of the animal required more room. These additions go on with the greatest regularity, and correspond accurately in all the species, with the exception of some few, which may be considered sports of nature, and not generic distinctions. By counting these periodical additions, we come to the same conclusion regarding their age as with the Wentletrap. We can indeed say that such a shell is not an adult one, by counting the number of varices, but it has not yet been determined what period of time is necessary to complete the standard measure. *Helices*, and their congeners, never form a thickened lip until their full growth is attained. Double-lipped shells have been described, but they are extremely rare. We shall point out the mode adopted by nature in forming the snail shell, in which it will be seen, as before stated, that it is formed on the animal's body. It is equally certain, though not so easily proved by observation, that those shells which have claws, as they are termed, such as the *Pteroceras* present, or foliations and spines, as the *Murices* exhibit, must depend wholly on the form of the skin of the mantle and its age, by means of which these were formed, its lobes, prolongations of portions of the mantle, the organs of respiration, the head, oviduct, &c.; each producing, by their habitual uses, the spines, claws, canals, and other parts of the external covering of the animal. If the edges of the mantle of the animal are even, the termination of the shell is the same; if waved, so is the external edge. Where digitations of the mantle exist, they are equally protected, and become, as we have stated, claws or spines; tubular in their early growth, but rendered solid by repeated deposits of testaceous matter, exuding from the mantle in certain proportions, till the period of its full maturity. The animal then declines; its dwelling is sufficient for the protection of its body; the wants of its life in seeking food, or in moving from one spot to another, during the completion of its growth, require an extension of those parts, at first but slightly defined, and they are not in the full exercise of their adult functions; but these extended organs in youth are much greater in proportion, and frequently more numerous, than they are in the stage of decrepitude, when they begin to disappear, and the activity of their offices gradually decline, being no longer required to complete most of their destined operations. As a general deduction, we repeat, it appears quite certain that the spines, tubercles, and claws of shells, however solid they may be met with, have all of them, at first, been channelled or grooved, to defend certain exposed organs in those which have the canal or slit on the under side, and they are by far the most numerous, having been produced by the digitations of the mantle; while those which have the slit on the upper side, as in the *Purpura* and *Venus Dione*, (Linnaeus) appear, on the contrary, to have been produced by the concavity of an appendage to the mantle, which projected on the outside.

Nothing certain appears known of the age of shells, though we have just remarked that certain stages of growth are marked by signs of the shell being then finished; their growth probably in many species, under favourable circumstances of climate

and food, continues for a definite period ; with regard to the animal, whose increase of bulk requires increased accommodation in its shell, as would appear particularly in the genera we have already named, and in all the other genera whose varices, whether spinous or foliaceous, seem placed at stated intervals, some being found at the half turn of the whole circumference of the shell, others at a quarter, some one third, and some perpendicular to the base ; others at the sides of the shell, giving it a flattened or ventricose appearance, according to the position of these previous terminations, which, it must be again observed, are formed of the vitreous, and not lamellar substance. In bivalve shells, also, the period of growth may be traced by their striæ, and they seem also to have a limited extent of increase, as, generally speaking, the various genera attain a tolerably uniform size. Their age is, however, more strongly marked by the thickness of the valves, and the internal muscular impressions, than any other guide. The valves of shells having a continual tendency to fly open, in consequence of the elastic ligament situated at the side of the hinge, which operates as a muscle, it was necessary that the animal inclosed should have the power of closing them at pleasure. There are, therefore, according to the different genera, always one or two muscles fitted for this purpose. In the oyster there is only one muscle of this kind, situated near the centre of the shell, behind the liver, and in the middle of the cloak. It is inserted into both valves, and by its contraction brings them together with an astonishing force, equal to the pressure of many hundred pounds weight. The same mechanism prevails in the *Perna*, *Avicula*, and *Spondylus*. In young shells these muscles leave a fainter impression than in old ones, in which the increased substance of the valves render them deeper. They are, as it were, always advancing more towards the edge of the valves, not that these muscles are ever displaced entirely, but new portions of them are formed as the animal finds it necessary to occupy a convenient position in its dwelling ; the posterior parts of the muscle become inactive, and die away, whilst others replace them on the anterior part, and so on during the life of the animal. These muscular impressions also afford an excellent guide to the genus of animal to which a shell belongs, where no other opportunity presents itself of judging. The difference which exists in the size of shells of the same species, particularly in such as have not the strongly marked lip, or other final termination, is very remarkable. It does not appear easily accounted for, but a similar anomaly exists in every branch of natural history ; and it may therefore be attributed chiefly to the strength and constitution of the animal, being always proportioned to the favourable or unfavourable situation of its habitat, and the goodness of its nourishment in peculiar situations. Another extraordinary occurrence is, the elongation of the spires of some univalve shells, in which the whorls do not touch each other, but appear drawn out like a coiled spring. The *Scaloria* and *Helix* are those in which that lusus has been observed, though it is very rare ; but the greatest monstrosity of all, the most inexplicable freak of nature, is displayed in such shells as are sinister or heterostrophe, that is, having their whorls turned to the left instead of the right. This can only be accounted for by the viscera of the animal presenting a change in their

position, which of course is followed in the formation of the shell, this is to be understood, but the former baffles inquiry. Such a phenomenon might therefore occur in every species of mollusc, and does so in numerous instances ; but some of the genera, particularly of terrestrial shells, are more commonly left-handed than on the contrary. These, however, do not, in the opinion of the author of this article, constitute anything beyond a variety or sport of nature, though constantly occurring in some genera.

The probable number of shells in a recent state, can only be guessed at ; as, in addition to the species already known, naturalists and travellers are continually increasing the amount by new researches ; but judging, which may fairly be done, from the immense beds of the vestiges of former testaceous animals, we may conclude, that living examples exist in countless myriads.

The mode of production is various ; some of these creatures are viviparous, or bring forth their young alive, as is the case with most of those which inhabit bivalve shells, multivalves, and even some of the univalves, while others, which form by far the greater portion of such as are known, are oviparous, or produce their young from eggs. The animals constructing shells, do not, generally speaking, exhibit any known affection towards their progeny, though many possess that wisdom termed instinct, in depositing them not only in secure places, but especially where food, the first want of nature, will be amply supplied, without much trouble to obtain it. Adanson mentions that the female of the *Voluta gondola* of the Linnæan school, collects its young for some time together in the fold of its foot, and the female of the oviparous *Paludina* also carries its young some days on its shell. Species of the *Buccinum*, *Purpura*, and probably many other genera, whose eggs are pedunculated, or having a stem, are attached, at their exclusion, to the neighbouring substances. The *Janthina*, which is always found floating, surrounds its shell with eggs ; the snail and others of its congeners conceal their eggs in the hollow of trees, beneath stones, in damp places protected from the sun ; the *Ocythoë*, of the *Argonauta*, appears to place its eggs at the bottom of the shell it inhabits ; muscles attach their young by means of their channelled foot ; and *Balani* do the same with the long tube which terminates their oviduct. Most other molluscs lay their eggs as chance directs ; and it is possible, from the viscous matter that surrounds them, they are enabled to adhere to marine substances, where, at the period of their development, they find themselves the most advantageously placed according to their future wants and habits. By far the greater number of eggs produced by molluscous animals are mucous ; some are horny, and some are covered with a calcareous coating, resembling those of birds, as is the case with one or more species of *Achatina* and *Bulinus*. In one fact all naturalists agree, that whatsoever the mode of production, whether from an egg or otherwise, the shell is formed on the body of the young animal proportioned to its then bulk ; the increase this shortly requires, and the consequent necessity of enlarging its shelly dwelling, we will now explain. For this purpose the common snail shall be our preceptor ; its example holds good with all shells, being formed of spiral convolutions, whether they are aquatic or terrestrial. The principal use of shells is, doubtless, to cover the animal entirely when in want of such a protection, or merely

to defend certain delicate organs most subjected to injury. Some writers have considered them analogous to the bones of other animals, although its formation and growth are widely different, since it serves as a base or support to the muscles which are attached to its internal surface.

Reaumur, to whom we are indebted for numberless interesting and accurate observations of the phenomena of nature, thus describes the increase of shell which takes place after the development of the animal and its progress of growth:—"The enlargement of shells after this period is owing to successive additions of calcareous and animal matter, independent of any organised structure. When a testaceous animal is about to enlarge its shell, the common snail for instance, and its body has become too large to be covered securely, it projects a portion of its body from the opening; it then attaches itself to a wall or other solid substance, and the naked part is soon covered with the fluids which are excreted from its surface; the pellicle, or covering, which they produce, when the fluid dries, is, at first, thin and elastic, but gradually assumes more consistence, and becomes at last similar to the whole part of the shell. If, in this stage of the process, a bit of the shell is broken off and removed without injuring the body of the animal, the skin of the snail is soon covered with a fluid which gradually thickens and becomes solid. In about twenty-four hours after the operation a fine crust may be observed, which constitutes the first and external layer for repairing the breach that was made; at the end of some days this layer becomes thicker, and in ten or twelve days, under favourable circumstances, the new piece of shell has acquired the same thickness as that which was removed, but it never unites in the same way, being only as it were a plug. If, after the broken piece has been removed, particularly if the fracture is made near the edge of the opening, the animal is not supplied with a sufficient quantity of nourishment, its bulk is soon diminished, and now finding what is left of the shell equal to completely cover its lessened body, no exertion takes place for the production of a new portion. It is obvious, snails, &c., cannot enlarge in volume but by the augmentation of the whorls, and that each previous turn of the spire remains the same in length; these make a great difference in the size of the shell, by the last and additional one, each being calculated to contain nearly double that of the preceding one; but in many shells, both marine and river, the last whorls of the spire, compared with the preceding ones, greatly exceed this proportion. In some, the external opening is twelve times greater, or from eight to twelve: this depends entirely on the increase of the animal's body, and the duration of that increase. Those testaceous animals which have only a few turns in the spire of the shell are of this description; to the former belong such as have a greater number of turns; the growth of shells, being proportioned to that of the inhabitant, proceeds almost imperceptibly. In most shells this, however, is marked on the convex side with lines, more or less fine, giving the shell a fibrous appearance; these are called *striæ*, which may be traced through the whole of the shell, in bivalves and in the longitudinal direction of those which have a spiral form; they cannot receive any addition without that progress being discovered on a minute examination. These inequalities must become visible, for the smallest addition of testaceous matter which is made,

must be attached to the old part of the shell, and consequently, must be more elevated than the former; whatever be its thickness, the increase, or rather the interruption of the growth is thus distinctly marked; and they have some degree of analogy with the different shoots of trees, checked by the cold of winter or advanced by the heat of summer, as is remarked in such shells which live on the land, or inhabit rivers in temperate regions; in these the shell is not enlarged during those seasons; it is otherwise, however, with regard to its thickness, for that is continually going on, from the constant exudation of small quantities of fluid from the animal's body; this addition is generally marked also by a fresh coloured stripe or band, darker than the present one."

That which appears certain is, that the growth of shells is extremely slow, and that their inhabitants are able to exist a very long period without food, particularly such as can screen themselves entirely from exterior circumstances, as is the case with the *Helix*. This is the more remarkable as the animal has not a stock of fat to exist upon as in some hybernating animals; that substance never existing in molluscs. Numberless instances of this could be adduced, and among others proving the tenacity of life in snails, the writer has received some of their species closely packed with marine shells from the Mauritius, which the day after their being unpacked were discovered wandering about, apparently uninjured by their confinement. Some lived ten days, but a want of proper food, or more probably an uncongenial climate, then killed them. Another instance is recorded in the Philosophical Transactions, of snails having resumed their wonted habits, after having been imprisoned in a cabinet *fifteen years*; this is not, however, *vouched for* by the writer of this article.

These remarks are so easily corroborated by every day's observation, that they need not be enlarged upon, and those who are disposed to examine some of nature's interesting operations, will do well to begin with such as are not attended with philosophic cruelty; and as the formation of the snail's shell illustrates the growth of all similarly constructed habitations, a more attainable object cannot well be pointed out.

Having, as we think, explained the mode of increase adopted by the animals of a large proportion of the various genera of shells, we will now shortly describe a difference which exists in another very extensive division, called, by some naturalists, porcelain shells, on account of their smooth surfaces and high polish, resembling china-ware, in these there are two sets of colours, disposed in a parallel direction to each other. The external range of these colours is owing to a peculiarity of structure in the animals which inhabit them, different from that of other testaceous animals, and to an operation which does not take place in other shells. In these shells the colouring matter seems to be always deposited in two different ways, and at two distinct periods. In the first process, when the body of the shell is formed, the colouring matter is excreted from the glands in the body of the animal, and it is arranged according to the disposition of those glands. At this period the shell is only of a very moderate thickness, much less than it afterwards acquires when completely formed. *On the external surface of the shell* thus formed, another layer is deposited, which is more compact than the former, in some places thicker than in others, and usually variegated with different colours; the external shell

being thus completely covered with the second layer the original colours are concealed, and if the same shell were examined at the different periods of its growth or increase, it would appear like two distinct species. In the genus *Cypræa* (common cowry), this is strikingly visible; the young shell is thin; the spire formed by its convolutions very distinctly marked, and the toothed, or grooved aperture, not at all indicated: in this stage it closely resembles some species of cones, and by early writers on conchology has been so classed. As the external deposition of matter continues, the thickness of the shell increases, the spire becomes less and less, till it is altogether obliterated, and an indentation is formed on the part it occupied, by the repeated coverings it has received; the matter also undergoes a change of quality; becomes more glassy or transparent, for it is to be remarked, that when a shell has attained the largest growth it is susceptible of, the skin of the animal appears to produce a greater quantity of calcareous, and less of the gelatinous matter; the atoms composing it are no longer in regular layers or leafy, they have become extremely compressed and heaped together, their structure vitreous, and assuming a

surface of its broadest expanse, or in more scientific terms, stratum super-stratum.

The lamellar structure of shells may easily be discovered by exposing the common oysters, and such as are so constructed, to the action of heat, when the animal matter which cemented the calcareous layers is destroyed, and they are shown in a foliaceous form. The fracture of the shell is another fact illustrative of its formation; an oyster never breaks short off, but in thin scales or portions, while the snail and bivalve shells break short off in the direction of their additions to the edge of the shell, some more readily than others, according to the density of the matter composing them. In the matchless Museum of the Royal College of Surgeons, there are some beautiful preparations of shells and madrepores, in which the calcareous portion of matter has been absorbed by a chemical process, not affecting the animal matter, which remains exhibiting the precise form of the shell, by far the greater proportion of which it constituted. The chemical analysis of shells has been carefully made, and its general result proves them to be formed of a gelatinous matter hardened by a calcareous salt. The species which contain the largest portion of animal matter, appear to be those of a fibrous and pearly structure, in these exist sub-carbonate of lime and coagulated albumine. Mother-of-pearl itself is composed of sixty-six parts of the first and thirty-four of the latter. The shells of oysters contain much less animal matter, and that which does exist, more resembles a gelatinous substance; Vauqueline discovered in it sub-carbonate of lime and phosphate of lime, with sub-carbonate of magnesia and oxide of iron.

The *Patella* (limpet), which is formed of an extremely compact lamellar structure, approximates the most, in its chemical composition, those shells, which are, in general, vitreous, or, as it is termed *Porcellanic*; these contain only a small proportion of animal matter, but a very large one of sub-carbonate of lime, without any traces of phosphate or sulphate of lime. Human chemistry has brought to light many wonderful phenomena, and has gone some length in elucidating them; but great as these discoveries have been, they are no more than as distant planets in the wide-spread firmament, when compared to the operations incessantly performing in nature's laboratory. By the aid of chemistry we may, indeed, decompose nearly every substance in nature—dissolve some of them into air—collect the gases again, and prove, by the test of the most accurate weights, that no portion of the original bulk is lost, though rendered invisible to the eye; it is therefore, almost demonstrable, that the globe weighs no more at this moment than it did at its first creation, the destruction of some portions of it contributing to the formation of others, nothing being lost. But here, human science stops; we cannot take the elementary atoms and fashion them into a rude oyster or rough pebble; in this the master touch is wanted, all the accumulated wisdom of ages past, or of generations to come, can do no more, can go no farther, than to approach nearer and nearer, by slow degrees, the impenetrable barrier eternally fixed between omnipotent wisdom and finite judgment.

Another constituent portion of many shells is an external covering called the epidermis, the precise use of which does not appear satisfactorily explained; it is evidently the epidermis of the animal's skin beneath which the shelly matter has been deposited

Young Shell.



Adult Shell.

CYPRÆA EXANTHEMA,

brilliant polish, from the continual friction of the parts of the mantle, as they pass constantly over the surface of the shell during the life of the animal; this is observable in all univalve shells, most particularly so in the cowry and its congeners; each addition to the rolled form of the shell is rendered thicker, and, when it has reached its full period of maturity, the lips of the opening are become extremely thick, and with those grooves which admit certain portions of the animal's body to pass through. Thus, the different modes of increase may readily be understood, and it is plainly quite distinct, from that which we have described as taking place in the snail and similarly constructed shells, in the one, a shell may familiarly be termed built by small additions of matter to its first formation, placed as it were in lines, edge to edge, as any thin substance would be rendered wider by carefully laying a coat of varnish on its edge, adding various others in succession, as each previous one becomes hardened; while in the *porcelaneous* shells, the deposition of matter is layer upon layer, over the whole

This epidermis is formed of a dried mucus, or horny matter, forming a covering more or less thick—in some shells it is more or less united, in others thick like fur, or disposed in ridges. In bivalves this part is formed of the same substance as the ligament, and sometimes totally envelopes the valves, as in the *Mya*, *Solen*, &c. Its growth keeps pace with the increase of the shell, whether it afterwards remains upon it or not.

The opercula of shells, though not absolutely a portion of them, nevertheless belong to the animal possessing them, and which, in the modern arrangement of Malacology, must be studied with their coverings; these interesting parts have been scientifically treated by Mr. Gray, F.R.S.; they tend greatly to assist in the classification of molluscs, to point out their structure, peculiar habits, and to form an admirable guide to localities, otherwise without positive indications.

The colouring matter of shells may be said not properly to belong to them: it is always extremely superficial, and is produced by the coloured pigment secreted on the surface of some portion of the animal's body; these are coloured atoms, deposited above the calcareous matter, and are of a different nature, since they form no necessary portion of the shell's strength, disappearing under circumstances of age, injury by artificial heat, the application of acids or other causes. The colours are always more vivid in young animals, and the recent portions produced by them. Anatomists have proved, that it is only the limb or anterior edge of the animal's mantle which produces these colouring molecules, for, if a hole is made in any other part of the shell than at its edge, the reparation is made with matter quite colourless, and forms a white spot. In the snail (*Helix nemoralis*), which is so elegantly zoned with bands of black upon a yellow ground, it may easily be seen that the portion of the animal's body corresponding with these, presents a tinge of that colour, so that a fracture made there, on the extreme edge of the shell, is restored by a similarly coloured portion to that injured or removed, provided the broken part is altogether removed, otherwise, we see in the snail, inhumanly crushed to a shapeless mass, repeated proofs of the reparations made by the animal being perfectly colourless, every where but at the lip of the shell; in this state examples may occasionally be met with, so industriously mended after what was deemed a total destruction of the animal, that its shell appeared made up of numberless patches, as variously disposed as Harlequin's jacket.

Though we have no certain proof that all other shells, whose coloured zones run spirally from the summits, are similarly formed, analogous reasoning authorises us to draw that conclusion; but with species whose colouring matter is externally deposited in oval, square or irregularly formed spots, and particularly where the transverse bands, or stripes, are in the direction of the additions to the shell's growth, that is, perpendicular from the summit to the base, the analogy is not so evident; without we subscribe to the doctrine of some naturalists, that there is a change, a displacement, either regular or not, in the colouring parts of the animal's mantle, under peculiar circumstances of structure, constant and undeviating as any other of nature's laws. These phenomena admit, however, of much speculation, and can only be explained by a long series of accurate observations of the animals themselves in the different

stages of their growth, a thing so difficult to come at, and requiring a particular train of study to benefit from, when within our reach, that we must content ourselves with well-grounded supposition, in the absence of positive proof.

We have just said that the coloration of shells is constantly superficial; this, however, must be qualified when speaking of such shells as we have described under the name of porcelanic, the cowry, and some species of olive. The formation of the cowry having been explained, it is obvious that, during the animal's young state, the colouring matter is external, and proceeds from the same causes as in other shells. This coloration is due to the edges of the mantle, and is gradually made as the animal increases in size; but, probably at a later period, when it has attained its complete maturity, the cutaneous appendages on each side of the animal's body, when it climbs, are elevated on the back of the shell, depositing that vitreous or glassy ivory coating, which gradually thickens it, and at the same time leaves a colouring matter, constantly presenting a different disposition to the first. It must then be admitted, that the upper part of these cutaneous lobes possess intervals where the pigment is coloured, imbuing the cretaceous matter exhaled from them; and, as it is very unlikely, indeed almost impossible, that these spaces or intervals in the development of the lobes, should exactly cover the part on which the colour is deposited a second time, it is easily to be conceived that the markings are necessarily irregular, and can never exhibit either bands or any other running design. An examination of the leopard cowry, in its adult state, will render this subject easily understood, and in the map cowry, though a more rare shell to meet with, it is yet more strikingly illustrated; in this, the space not touched, or totally covered, by the cutaneous lobes of the animal's body, is distinctly marked by well-defined lines, distributed in various curves like the face of a map, from whence its appropriate name. This is visible in the common and other cowries, but not so strongly marked.

We must also remark, that the colouring matter of some shells is occasionally on the *internal* surface, of bivalves in particular. In these exceptions to the general rule, the effect may be attributed, we think, to the matter deposited, and it appears to be produced by an impregnation of colour, gradually extending in depth as well as surface, occasioned probably by some humour of the animal's body, produced in any organ, the immediate contact of which with the shell, tinges it of the colour of that secreted fluid. This appears to apply to the yellow and brown interior of some univalve shells, which certainly is caused by the liver of the animal being in contact with them; the *Janthina* is also coloured by similar causes. It may, however, be generally asserted, that it is extremely rare to find the component strata of shells otherwise than white; they are, however, sometimes, as has been stated, both externally and *internally*, tinged with colouring matter.

We said that light and heat exercise a prodigious influence in the colouration of shells, as well as it does in the other portions of creation. All such as are inclosed in the interior of the animal, in holes of wood, chalk, or in other situations from whence they never emerge, are constantly white; but another more striking example may be adduced from certain bivalve shells, which being fixed more or less hori-

zontally, even where one valve is not attached to any substance permanently, the lower side is always colourless; the *Spondylus*, many *Pectens*, and some other genera, fully illustrate this fact. Shells inclosed in sponge, or other foreign bodies, are invariably colourless. It must, therefore, be admitted that one lobe of the animal's mantle not receiving the exciting action of light, produces no colouring pigment, and the contrary with regard to the other; or perhaps the pigment itself only becomes coloured by the action of light on the fluids of the animal's circulation, so that if the shells were removed from the place of their habitation, and their position reversed, there would be a consequent change in the coloration of their valves, which is exhibited in some species of the *Pleuronecta*. It may generally be remarked, that those shells the most exposed to the action of light and heat, are invariably the most brilliantly coloured. The *Helices*, which are terrestrial animals, in fact, vary the most in colour, and have them of the most vivid tints; but when they inhabit the umbrageous shades of the forest, they become paler, and less distinctly marked, than the same species living in open situations; the coloured portions of the shell itself are more intense than those partially concealed of the same hue.

Almost every colour of the rainbow is to be met with in shells, varying in their degree of intensity; the most common, however, are the brown and fawn; green is incomparably the most rare, the peculiar markings of these colours depending upon the anatomical structure of the animal secreting them, cannot so clearly be understood as we could wish; indeed, the causes are as yet very incompletely known, but they are infinite in their combinations and variety, and baffle the skill of man to imitate. What can exceed the beautiful pencilling of the *Cones* and *Volutes*, or the vivid hue of their colours, and those of many other genera too numerous to be here named.

It being understood that shells are the protecting coverings of the animals forming and inhabiting them, that they are of various forms, corresponding with the naked body of the animal; more or less thick, the fracture either short or lamellar, and constantly attached to the body of the animal; we shall now proceed to explain some of the technical considerations connected with the study of the science of *Testacology*, without any reference to its enlarged view, which will be entered upon under *Malacology*. In the first place, considering these bodies in a general point of view with regard to their structure, the first divisions of shells may be considered between those that are called *true* or *false*. A false shell (*pseudotesta*) is that not belonging to a molluscous animal, or rather a shell composed of small polygons, placed side by side, the whole forming a hard, brittle, calcareous envelop, as in the *Echini*. A true shell is that which is formed by laminae or strata, each one placed beneath the previous one, the most recent and considerable being the last internally deposited, the smallest in substance and the oldest in formation being the external; this applies to every species of shell, whatever may be its form, or the number of pieces composing it. A general study of that form occasions another division between such as are tubular or not, but little explanation is necessary to point these out, as every one will easily recognise them from such as are spirally formed. The nontubular shells are divided into such as consist of one piece—these are the *univalves*;

the *sub-bivalves* are those consisting of a principal and an accessory part; *bivalves* are all those consisting of no more than two pieces; *tubivalves* are such shells as have two principal pieces, with an accessory one; and the *multivalves* are such as have a greater number of portions or pieces. A valve is therefore a calcareous portion of shell, varying greatly in point of form, either concealed within the animal's skin, or protecting a greater or smaller portion of the animal's body. Multivalve shells are of three descriptions; those that are composed of transverse pieces, as in the *Chiton*; those that are formed of five valves, or more, symmetrically arranged to the right or to the left hand, sometimes placed in the form of scales united together by means of the animal's skin; these form a division established by De Montfort, under the title of *dissivalves*, as occurs in the genus *Anatiferae*; and, lastly, those shells in which the pieces or valves are placed in a circular manner, as in the genus *Balanus* and its congeners, which form Lamarck's *sub-coronals*. Tubivalve shells are those composed of two principal valves, as in bivalves, properly so called, but surrounded or enveloped by another piece in the form of a tube, which, nevertheless, cannot be considered as another valve; this is observed in the genera *Teredo*, *Fistulana*, &c. Bivalve shells are such as their name indicates, formed of two pieces, these two pieces notwithstanding being only one cover or dwelling for the animal inhabiting it; they are nearly in every instance placed on the sides of the animal, and connected with each other, inasmuch as the functions of the animal are double, and those which apply to one valve apply equally to the other. Where the valves are not entirely similar in their configuration much error has been occasioned; and Linnæus considered the *Lingula* an univalve, having seen only one valve, in the genera *Orbicula*, *Chama*, and some others; the dissimilarity of the valves, were they not well known to naturalists, might lead to similar false conclusions. Sub-bivalve shells are those in which, besides a piece analogous to that which constitutes the univalve shells, there is a second more or less perfect—calcareous or otherwise, closing more or less completely the aperture of the shell, which piece is called the operculum.

Univalve shells merely present one constituted piece, no matter what its form, or how differently it may be modified in the different species; it altogether forms an asylum for the animal in cases of repose or danger, or, as we have already stated, protects such organs of delicate sensibility as are the most exposed to accident. An univalve shell may be completely tubular, or entirely concealed in the animal's skin. Having drawn these distinctions, we will proceed to examine each of these species of shells, commencing with the most simple, and going on to the most complicated structure; but, in the first instance, we will define the terms derived from the analogous habits of each, which consequently apply equally to univalves as well as to bivalves. Shells, no matter what number of pieces compose them, must be considered as alike in various circumstances common to all, which we will rapidly examine. From the situation in which Molluscs are found, they have been distinguished into terrestrial; fluviatile, or those inhabiting fresh water; and marine, or those dwelling in salt water.

Terrestrial are such as are found on land, and are so organised as not to be able to exist in a fluid; they breathe air only.

Such only are known in the division of univalves and sub-bivalves, as it is quite impossible that bivalves or multivalves, which are tenanted by aquatic animals, breathing water, should be found on land.

Terrestrial shells are generally very thin; their exterior surface usually smooth, presenting no other inequalities than the striæ, indicating the different stages of growth, sometimes with piliform prolongations of the epidermis, but never with spines, or other protuberances properly so called; their internal or external surface is never pearly; their aperture is always entire, particularly in the adult state, with the right side of the lip thickened into a ridge more or less turned outwards.

Fluviatile shells comprehend all those that live in fresh water, whether stagnant or current; some of them are found in the three first divisions of shells, viz. the univalves, sub-bivalves, and bivalves, but none are yet known in the multivalves; the number of fluviatile shells is considerable compared with the others, and is confined to a very few families. So amongst univalves, the greater number known have the aperture entire, either operculated or not, but above all in the last group. One or two genera, at the most, have it grooved, though very slightly, as in the *Melanopsis*, and there is perhaps only one genus in which it is patelliform, like a *Limpet*. The bivalves of this section only belong to three or four families; the only ones known are those of the *Mytilus*, *Submytilus*, *Chama*, &c., and even then it is often a single genus, or a solitary species. Fresh water univalves and sub-bivalves are in general thin, since they belong to swimming animals; their external surface in general finely striated, without bands or varices, but sometimes with spines; and when there is an epidermis, it is always very thin. One of their general characters is that of having their aperture entire, but the *Melanopsis* forms an exception to the rule, not only in that respect, but as being often of a considerable thickness: thus the distinction between fresh water univalves and sub-bivalves is less easy than in the terrestrial. Fluviatile bivalves are nearly in the same case; it has, nevertheless, been remarked, that whether the substance be thick or thin, they have nearly always a rather thick epidermis, the valves shut completely, they are more or less pearly within, and the summits decorticated in most species.

Marine shells may be said to exist of all families, except those of the snail, and other of their congeners, and of the first section of the *Submytilus* among the bivalves. Their characters are opposed to those of the two first sections. Thus the univalves, and even the sub-bivalves, are in general much thicker, and more frequently marked with ridges, varices, and spines. Their aperture also differs from the preceding, by being very frequently channelled, and bordered on the right side by a simple or complex ridge. They are sometimes pearly on the inside; the epidermis is often scaly, piliform, and, generally speaking, totally different from either the fluviatile or terrestrial species. Marine bivalves are in general more rough on their exterior, with more strongly defined striæ, grooves, and rays; their epidermis is less smooth, even thinner, and usually of a very different form from that of the fluviatile shells. With regard to the parts of rivers, lakes, and seas, in which molluscous animals live, they are sub-divided into littoral and pelagic shells; the littoral are those, either univalves, sub-bivalves, bivalves, or multivalves, which inhabit

more or less constantly the sides or banks of rivers, lakes and seas; the pelagic arc, on the contrary, those molluscs always inhabiting the deepest parts of the sea, in consequence of which they are the most difficult to come at, and but generally only known through accidental circumstances. There is not, however, any permanent distinguishing character for these shells, so as to enable the naturalist to decide, by an examination of the shell only, to what habitat it belongs. A moderate degree of experience will, nevertheless, give certain rules going far to establish the fact, without any knowledge of the animal. There is not, either, any indications on the shells themselves to point out such of them as are found embedded (in some instances it is difficult to say how) in wood, stone, &c. As a general definition, these are called (*Terebrantes*) borers or piercers, and distinguished from each other, as *Petricolæ*, or *Lithodomæ*, when found in calcareous substances, of a more or less hard texture, as with the *Pholodes*, &c.; *Xylodomæ*, or *Lignivoræ*, when they have established their habitations in wood, as is the case with the *Teredo*; *Arenicolæ*, when they inhabit the sand; *Lutricolæ*, when buried in the mud of rivers, ponds, &c. An observation may, however, be here made with respect to such of the penetrating molluscs which inhabit hard bodies. They are only to be met with in some families of bivalves, and a tolerably uniform indication may be discovered in the larger and more rounded form of their anterior extremity. It is also pretty easy to distinguish, by certain marks, such molluscs as are more or less fixed in their local habits. These shells may be divided, in consequence, into those being (*Natantes*) floating, that is, inhabited by swimming animals. They are then wisely constructed of a very thin light substance, which is beautifully exemplified in the *Argonauta*, *Janthina*, *Bulla*, and others.

The *Liberæ*, or free shells, are such as are more solidly constructed, and presenting no sign of adherence, or power of attaching themselves to submarine or other bodies. This is the case with the greater proportion of shells.

Adhærentes, or adhering, when they are altogether immovable, or only possessing the power of moving in a very limited space. To the extent of their attachment, these are denominated

Fixæ, or fixed, when their attachment is by means of the adhesion of the substance of the shell itself, as is the case in univalves with the

Hipponix; in the bivalves with the *Spondylus*, *Oyster*, *Chamae*; and in the *Balani* among the multivalves.

Radicatæ, rooted, when the adhesion is effected by means of a tendinous part, as is the case with the *Terebratula* and *Lingula* in bivalve shells; the *Anatifæ* in multivalves. This Linnæus improperly designated *intestinum*, an error perpetuated by Brugniere, who translates it *intestine*. This adhering portion is often marked in the shell, but it is sometimes indicated by a hole or groove in one of the valves; and lastly, molluscs are called *Obtectæ*, or hidden, when they are concealed at a certain depth in a distinct tube, to which they adhere, or remain loose, enveloping the animal altogether, as in the genus *Fistulana* and its congeners. We will here describe the position of the shell as viewed by modern naturalists, in describing the various names ascribed to its different parts. In this a well-marked and

extremely rational change has taken place since the revision of the Linnæan school; and it is now the more useful, as it tends to facilitate naturally the connection we deem inseparable of the animal and its dwelling, which forms the leading feature of the science of Malacology. Our present object is, however, confined, as we have already premised, to the shells themselves, as detached portions; and before we proceed to the nomenclature of the science, the following easy guide should be well retained in the student's memory. It will be the more readily understood by an examination of the accompanying descriptive figure; or we may at any time observe the march of our garden snail as a living guide to the subject. In univalve shells, it is easily conceived that they must have had a point or portion from whence they progressed in growth, a base which is its actual termination in its final stages of increase, or in its adult state of maturity, with an intermediate state between these, which may be called the body of the shell. This portion sometimes possesses an almost imperceptible cavity in such as are extremely depressed, or altogether flat, in which they partake greatly of the character of one valve of a bivalve mollusc.



PLEUROTOMA BABYLONICA—*a*, the canal; *b*, the nearly closed umbilica; *c*, the left or intestinal edge or lip; *d*, the right or external lip; *e*, the notch or slit; *f*, the sinus; *g*, the belly; *h*, the turns or whorls of the spire; *i*, the sutures.

Linnæus, of the old, and Lamarck, of the modern school, placed the shell they were about to describe on the opposite extremity to the summit, its only natural position when separated from the animal, but with the *aperture* fronting the spectator. Modern naturalists, on the contrary, place the shell as it is found on the animal when proceeding on its march, that is, with the *spire* towards the observer, the summit consequently upwards and behind, and the opposite portion, or the base, as it is generally called,

in front and beneath. In this mode of examining a shell, it is clear that the right and left side apply equally; but the one so called by Linnæus is now, by reversing the position of the shell, exactly the contrary of modern authors. The right of the old system is the left of the modern, and *vice versa*. The terms, *inferior* and *superior*, in the description of the aperture and its edges, are necessarily replaced by the terms, *anterior* for the first, and *posterior* for the second. The *apex*, or summit, is that part from whence the shell first proceeds, or, more properly, it is the commencement of the spire. This portion may be altogether flat, or very salient, straight or vertical, or directly leaning backward, to the right or to the left, or even forward. It may be pointed, mamillated, entire or carious, and even sometimes hollow, as in the *Bulla*. Thus the summit is altogether *planus*, or flat, as in the Chinese limpet; *peracutus*, or very salient, as in the *Vermetus*; *verticalis* or vertical, as in the *Patella* or limpet, whence Linnæus has called it (*vertex*;) *marginalis*, and *sub-marginalis*, as in the *Crepidula*; *retroversus*, depressed backward, as in the *Navicella*; *anteversus*, the converse to the latter position, as in certain species of *Patella*, and, above all, in the *Emarginula*; *sinistralis*, or left-handed, as in the *Ancylus*; *dextralis*, as in the *Capulus*; *acutus*, pointed, as in a great number of shells; *mamillaris*, mamillated, or rounded, as in the *Volutes*; *integer*, or entire, as in the greater portion of shells; *cariosus*, eroded, or carious, as in the *Bulinus thiara*; *truncatus*, or *decollatus*, as in the truncated *Bulinus*, and several other species of turriculated molluscs; *umbilicatus*, umbilicated, hollowed, sunk in, as with the *Bulla* and their congeners, as also with certain species of *Ammonites* and *Planorbis*, but then the apex is lateral; *terebratus*, pierced, as in the *Dentalium*. *Basis*, or the base of a shell, is that part which is usually opposed to the summit, and in which the aperture is formed. Under this name, however, we do not understand that which Linnæus and his disciples have designated as the base of a shell; for in fact, according to their view, it is the extremity, pointed or not, which is opposite to the summit, and they made it so, because, according to their method of designating the different parts of shells, they placed this one vertically, the summit above and the aperture behind. In the present school, the base comprehends all that part which rests more or less obliquely on the back of the animal. Sometimes this base is very large and round, *ampla*, *rotunda*, as in the *Trochus*, which gives them the form of a reversed one; sometimes it is *parva*, small, as in the *Terebra*, *Subula*, &c. It may be extremely elongated, *elongata*, as in the *Cypræa*, &c.; and it is formed entirely by the aperture, as in the *Patella sigaretus*; but many other molluscs more frequently have their base formed by a portion of the last turn of the spire.

The direction of the base, which is usually in that of the opening, also offers some considerations deserving notice; it is altogether perpendicular to the imaginary axis of the shell in the *Patella*, *Solarium*, &c.; it is almost entirely in that of the aperture in the *Oliva*, *Cypræa*, &c.; in other shells, it is more or less intermediate.

That portion of shells termed the body occupies the whole space between the summit and the base. It is most frequently hollow, and not only serves as a covering, but also contains the whole, or a part of the animal's body.

Sometimes the name of disc (*discus*) is given to the base of shells, as in the *Haliotideæ*, but it is then only the last turn of the spire which is comprehended under that name.

In a certain number of shells, the body part is not inclined in any direction, either to the left or right, forward or backward, and it is not at all excavated; the shell is then truly a flat shell, symmetrical in the *Sepia*, &c., and not symmetrical as in *Patella Sinensis*. It frequently occurs that the base and the summit are united by a portion not curved in any direction, but more or less excavated. These we have already designated as shells covering the body of the animal altogether. This occurs in the *Patella*, *Emarginula*, and particularly in the *Dentalium*; most frequently, however, the body of the shell is formed by its convolutions in their various directions, whence they are properly called spirivalve (*spirivalvæ*). To illustrate this familiarly, suppose all univalve shells to be of a conical form, more or less elongated, the *Dentalium*, for instance, and imagine it flexible; if this be rolled up, or curved from the posterior part forward, and from the top to the bottom, positively in the same vertical plane, the result would be a discoid shell, compressed from the right to the left, the summit of which can only be visible in the same direction, and the axis of which is everywhere equally transversal. Such shells may be called rolled up (*revolutæ*). An example strictly in point may be found in the *Argonauta* and its congeners; but the *Planorbis*, though in some respects analogous, are in fact only *sub-revolutæ*.

The principal distinctions, and the various modes in which shells are rolled, consist in their greater or less degree of perfection. They are called arched (*arcuata*) when the shell presents only a slight curve, as in certain species of *Belemnite*, and as in the *Dentalium*. Curved (*curvata*), as in the *Ammonoceratites*, the shell presenting a much more circular curve.

Half-coiled (*semi-revoluta*), when the shell is so curved as that the turns of the spire do not touch, which occurs in the *Spirula*, presenting a spiral coil on a plane.

Coiled (*revoluta*), when the turns touch each other, as is the case with the true *Ammonites* (*per-revolutæ*), when the spiral turns penetrate each other in such a way that the last conceals all the others; which is illustrated by the *Nautilus*.

If, on the contrary, the revolutions of the spiral cone are formed transversely from left to right, as placed on the animal, such shells are termed involuted (*involutæ*), or, as Linnæus calls them, *convolutæ*, convoluted. In these species the base is nearly the whole length of the shell, as well as the aperture, and the axis of revolution is necessarily longitudinal. In fact, shells are scarcely ever completely involuted. Those which the nearest approximate that form are the *Ovulæ* and *Cypreæ*. Sometimes the shell does not form a complete turn, as in the *Bulla*, and then the aperture is as large and as long as the shell itself.

The greater proportion of univalve shells are, however, intermediate with the two above-described formations; that is to say, the body of the shell is the result of an oblique revolution from right to left, and from the lower to the upper part, if we proceed from the bottom to the top; or, on the contrary, which is more natural, if we view the shell according to its progress of growth. Such are the true spiri-valve, or turbinated shells.

The name of spire (*clavicula*) is given to all that portion of the shell which is formed by the revolution of the spiral cone. Sometimes the last turn of the spire, which is usually the largest, is distinguished by the name of body (*corpus*); the part corresponding with the aperture is the belly (*venter*); that which is opposed to it is the back (*dorsum*): to all the other parts of the shell the term *clavicula* applies. By far the greater number of molluscs terminate on the right side of the animal; some, however, which we have pointed out, terminate to the left; and this circumstance distinguishes the sinister from the dextral shells, *dextræ* and *sinistrorsæ*.

Having thus pointed out some of the leading distinctions which characterise the plan of formation presented by shells, we shall briefly enumerate the scientific terms applied to the position of the shell with regard to its inhabitant, leaving the general nomenclature to an alphabetical arrangement.

Dorsal (*dorsalis*) shells are such as are placed on the back of the animal. Of these there are only examples to be met with in the univalves and sub-bivalves; and in the *Chiton* among the multivalves.

Ventral (*ventralis*) applies to shells placed beneath the animal's belly. The genus *Ombrella* may be supposed so situated.

Dorso-ventral (*dorso-ventralis*) are shells composed of two pieces, the one on the back, the other beneath the belly, as in the *Terebratula*, *Lingula*, &c., and others of the class *Palliobranchiata*.

Bilateral (*bilateralis*) are those of which the component parts are, one on the right, and the other on the left of the animal, as in the *Ostrea* and its congeners, which occurs in all the class of the *Lamelli-branchiata*.

Perisomatic (*perisomatica*), when the pieces forming the shell beyond the number of two, surround the body of the animal, as occurs in the *Balanus*, *Anatifa*, and their congeners, constituting the class *Nematopodes*.

External or internal shells have been so called from anatomical investigation of their position with regard to the animal. External is applied to nearly all shells which cover the skin of the animal, and it is so obvious, that no further explanation is requisite.

Internal shells are those in contradistinction to the generality, which are partially covered by some portion of the animal's skin, more or less thick. The shell is then, for the most part, very thin, flat, or only slightly revolved. It is constantly of a pale colour, and does not ever possess an epidermis. No examples of these are found out of the order *Polythalamacea*, or many chambered shells, as also of the single chambered, or *Monothalamacea* order. Certain species of *Mya* may also be presumed so situated as to be properly termed internal shells.

The terms applicable to the structure of shells depend upon the solidity and arrangement of matter composing them. Thus shells are called solid (*solida*) when they are heavy and capable of resisting considerable violence, such as the *Mitres* and *Olives* in univalves, and the *Spondylus*, *Crassatina*, *Pectina*, and other of the bivalves; fragile (*fragilis*), when on the contrary.

Thick (*crassa*), generally understood to apply to the valves rather than to the whole shell.

Thin, papyraceous (*tenuis*, *papyracea*), when the shell is excessively thin.

Transparent (*translucida*), when such thin shells

permit of the rays of light to pass partially through them, as is the case with the *Carinaria*, *Anatina*, &c.

Lamellar (*lamellosa*) or foliaceous (*foliacea*), when the strata of matter are not compact and solid, particularly towards the edge of the shell, as in the *Oyster*.

Fibrous (*fibrosa*), when the shell fractures in a perpendicular direction, from its summit to the base, as in the *Pinna*.

Nuda, or naked, as in shells whose surfaces appear highly varnished: the *Olives*, *Cowries*, &c.

Corticated (*corticata*), or epidermata, when the edges (of the stria of increased growth) form on the surface of the shell, an envelope more or less thick, the appearance of which occasions their being distinguished as furry or scaly.

The chemical composition of shells separates the species into such as are sandy (*arenaceæ*), in which the calcareous molecules are not united with each other, so that they may easily be reduced to small portions or grains, as in the *grey snail*.

Cretaceous (*cretaceæ*) or chalky, when the superabundance of calcareous matter, renders the shell extremely friable, as in the *Tubicola*.

Horny or membranaceous (*membranosæ*) when, on the contrary, the mucous matter constitutes nearly the whole of their substance, as in the *Aplysia*.

The colours of shells, as of everything else, does not admit of any misunderstanding, and must be applied according to the ideas each one forms of their degree of intensity. They are infinite in their combinations, though not a very important consideration, as they do not affect any peculiar arrangement; they may, therefore, be noticed under two heads. Superficial (*superficialis*) as in shells, externally coloured, as most species are; or imbued (*imbutus*) as in shells, where the colouring matter penetrates the substance, such as the *Janthina* and others.

The system of coloration, or as it is more familiarly termed, the marking of shells, gives rise to the following generally used distinctions. It is uniform (*uniformis*) when equally distributed over the whole surface of the shell; or variegated (*variegata*), on the contrary, when the colouring matter is variously arranged, and these differences of marking are called fasciated, ribboned (*fasciata*), when the zones or bands are of a different colour from the groundwork; it may be fasciated longitudinally, when they run from the summit to the base, following the direction of the whole of the spire. In bivalves this is distinguished by radiated or rayed (*radiata*); or, if in the direction of the striae, which mark the shell's growth, they are termed transverse (*transversalis*); lincated (*lineata*) when the coloured bands are closely placed, like hair lines, as in the *Bulla physa*; lettered (*scripta*), when the bands are more or less waved or broken, resembling Arabic characters, as occurs in some of the *volute*s. Tessellated (*tesselata*), when the system of colouration presents large spots, or other shaped marks, comparable to inlaid marble or mosaic work. When these markings are round, or nearly so, they are called spotted (*maculata*), and when the spots are disposed in bands, the shell is said to be ribbon-spotted (*fascio-maculata*); when the spots are very small, resembling fly-marks, they term it dotted (*punctata*), and *fascio-punctata*, when these minute dots are disposed in bands.

Of the general form of Univalve and Sub-Bivalve Shells.—In considering the general form of Univalve shells, without paying attention to the distinction of their parts, certain terms are used which, although

rather vague, must necessarily be known. The first distinction regards the equality or inequality of the two sides of a shell of any form whatever, separated by a fictitious axis drawn from the summit to the base, or from one extremity to the other. A symmetrical shell is one whose valves are perfectly equal, and a non-symmetrical shell, such as has its valves unequal, thus the shell of the *Argonauta*, the *Lippet*, &c., are symmetrical; the *Sigaretus*, and many others, are non-symmetrical.

A flat shell (*plana*), is that which has no cavity; tubular (*tubulosa*), that of which the diameter is considerably less than its length, as in the *Dentalium*; recovering (*aperiens*), that which is conical, and without a spire, properly so called, and so placed on the animal as to be easily taken off, as with the *Limpet*; spiral (*spiralis*), that which is more or less twisted in various fashions, as we shall more fully explain hereafter; but for the moment we will continue to define some terms belonging to the shell examined as a whole. It is called discoid (*discoidea*), when it resembles a disc, and which, considering the manner in which the spire is evolved, we call rolled up, as occurs in the *Ammonites*; depressed (*depressa*), such as are oval, or rounded very flat, the spire very short, as the *Sigaretus*. The same name is sometimes employed to designate certain shells whose last whorl, or the body of the shell, enlarged by lateral bands, appears flattened from the top to the bottom, as in the *Ranella*; globular (*globosa* or *ampullacea*), that in which the diameters are nearly equal, occasioned by the great development of the last whorl of the spire, which is much larger than that which preceded it, as in the *Ampullaria*, &c.; oval (*ovalis*), when the longitudinal diameter is rather longer than the transverse, as in the *Cowries*, *Olives*, and many others; bordered (*marginata*), when the edges are of a greater thickness than the rest of the body, as in some species of *Cowry*, &c.; navicular (*navicularis*), some shells which, reversed on the back with the aperture upwards, have some resemblance to a little boat, as in the *Argonauta*; pyriform, when one of the extremities is inflated and rounded, and the other pointed in the form of a short tail, as in the *Pyrula*.

Claviform, club-shaped (*clavata*), when the body of the shell is short and inflated, and the anterior part narrow and lengthened, as in the *Murex haustellum* (Linnæus). Beaked (*rostrata*), when it is terminated at its two extremities by a prolongation of the form of a beak, as in the *Ovula birostris* (Lamarck). Conical (*conica*), when one of its enlarged extremities is as if it were cut square, the other being pointed and forming the summit; when it is the summit itself of the shell which forms the summit of the cone, it is then called a turbinated shell, as in the *Trochus*, and the *Turbinella*; and it is called conical or conoid, when, on the contrary, the summit of the cone is at the anterior part of the aperture, as in *Cones*, properly so called. Cylindrical (*cylindrica*), when the shell is lengthened, and nearly of the same size throughout, as occurs in most of the involuted shells, such as the *Olives*, &c. Fusiform, spindle-shaped (*fusiformis*), such as are swollen in the centre, and pointed more or less at the two extremities, as in the *Fusus*. Turriculated (*turriculata*), those that are very much elongated, that is, whose longitudinal diameter is much greater than the transverse, which depends on the manner in which the spire is formed, as in *Turritella*. After this short explanation, univalve shells may be considered with regard to the distinction of each of their parts. A con-

sideration of the different terms applied to the spire, and other parts of univalve shells, would lead into a description of terms generally used in every elementary treatise on conchology; but as it would occupy a larger space than can be devoted to the subject in a work of this kind, we will proceed to point out some of the leading characteristics of bivalve shells, as we have already done with the univalves. And here, as with them, we will first of all point out the established position from which the relative terms are taken, which is here figured.

Fig. 1.

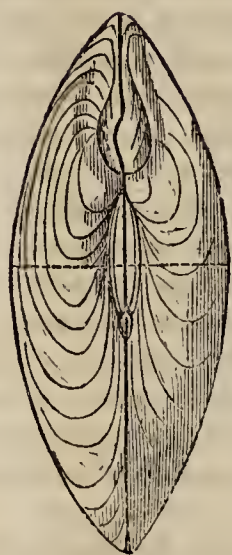
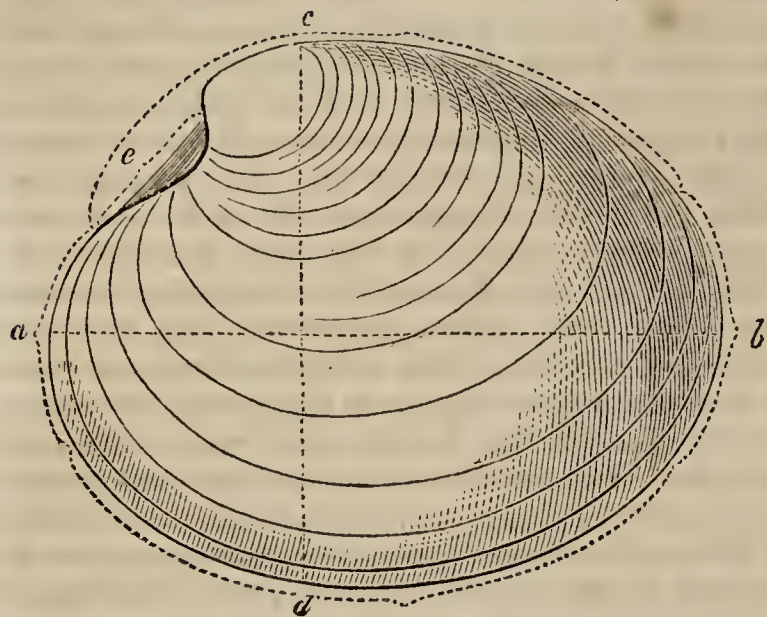


Fig. 2.

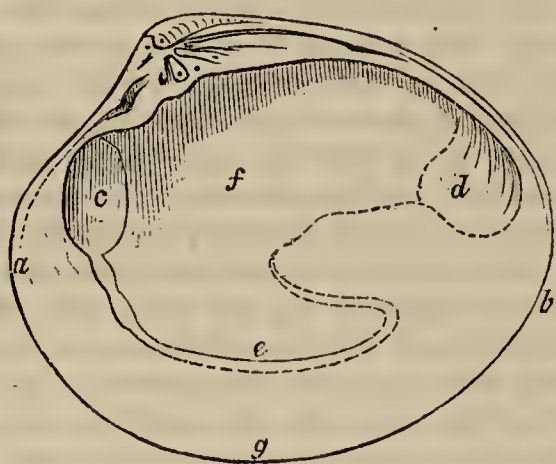


Fig. 3.

Fig. 1, *a*, *b*, length of the shell; *c*, *d*, height; *e*, lunula, above which is the summit; *d*, the ventral or inferior edge.

Fig. 2, the line across marks the thickness of bivalves.

Fig. 3, *a*, anterior extremity; *b*, posterior; *c*, *d*, *e*, *f*, muscular impressions; *g*, lower edge of the left valve.

Viewing, therefore, a bivalve shell, composed as it were of one piece, we shall explain that which is understood by long, elongated, cylindrical, transverse, thick, compressed, or very thin. We have already assumed as a point from which we shall invariably depart, that we suppose the shell covering the animal and walking away from the observer (although in fact many of these molluscous animals do not move from the place in which they were born); some others, it is true, assume positions in which the head even is downwards, when the shell would be placed on its edge, in such a way that the summits would be nearly always upwards, and very rarely forward, with the ligament between the summit and the observer. In this position the part opposed to the summits will be inferior, and the two extremities of the diameter perpendicular to this direction, will be one anterior and the other posterior. Linnæus, Brugnière, Lamarck, Bosc, and many other naturalists, have described shells alto-

gether imagined in an opposite position, that is to say, resting on their summits, the aperture upwards, and the ligament forward. According to this position, the height of a shell will be taken from the vertical diameter extending from the summits, or from the ligament to the inferior or abdominal edge, supposed to touch the place on which the shell rests; that is the length with Linnæus and others. The thickness, (*crassitudo*), will be indicated by the transverse diameter of the most inflated part of the two valves, whence the right valve will really be that which corresponds with the right side of the animal, and the same with the left. We should then name the back of the shell, or the superior margin, that which in fact corresponds with the back of the animal in which ordinarily the summit is placed, but still more frequently the ligament. The opposite side will be the abdominal side, or inferior margin, that is its real base. In this light Cuvier and others have viewed the position of bivalves, but it is the reverse with Linnæus, Lamarck, and many other naturalists.

The circumference of the shell, or the line which unites the four points just mentioned, forms the margins of the shell; in this position it would be easy to understand what is meant by a long bivalve, &c. It is long (*longa*) when the horizontal diameter is much greater than the vertical, as in the *Pholas*, *Mya*, &c.; it is a transverse shell of the Linnæan school. Height (*alta*), in a contrary sense, as in the *Vulsella*. Oval (*ovalis*), when one of the diameters is but a little longer than the other, as in the *Venus*. Round (*rotundata*), when the two diameters are nearly equal, as in the *Pectens*. Thick (*crassa*), when the transverse diameter is as great as the others, upon which depends the depth of the valves, as in the *Cardium*. Compressed, thin, very thin (*compressa*), when this diameter is more or less small in proportion to the others, as in the *Tellina*. Cylindrical (*cylindrica*), when the longitudinal diameter being very great, the two others are nearly equal, as in some species of the *Solen*. Navicular (*navicularis*), when the diameter, antero-posterior, being evidently much larger than the two others, the latter are nearly equal, which gives the shell a fancied resemblance to the hull of a ship, particularly when the dorsal margin is straight, as in the *Arks*. Cordiform, heart-shaped, (*cordiformis*), when seen from behind, in front, or at the side, it offers some resemblance to the received form of a heart, as in the *Isocardia*, &c. Triangular (*triquetra*), when the shell is as if truncated at its anterior extremity, but much more frequently at its posterior, so that a horizontal section, made of the whole shell, would form a triangle, this is illustrated in the *Trigonia*, *Donax*, &c. Tongue-shaped (*linguiformis*), when it resembles the form of a tongue, as in the *Vulsella*. Rostrated, beaked (*rostrata*), when the posterior extremity is much narrower than the anterior, as in several species of *Tellens*. Truncated (*truncata*), when it is, positively, as if one of its extremities were cut off, as in several species of *Donax*. Eared (*auriculata*), when the margins of the shell, towards the summit, are more or less dilated into certain portions, termed ears. Inauriculated, when only one of these appendages occurs. These ears are equal, or unequal, when of the same size, or differing from each other in size; they are spiny, when their inferior margin appears toothed; obliterated, when they are but slightly angular, as in the *Lima*.

The valves may be regular or irregular; they are regular when they present an uniform shape, totally independent of all exterior bodies, as is the case with

most bivalve shells; on the contrary, the valves are irregular when they assume the shape of the substance to which they adhere, such as the oysters—*Anomia*, &c. This occurs with both valves in some instances, as the form of the upper is necessarily modified by that of the lower valve: whether the valves are thick or thin, is so obvious, that no particular term is necessary. The valves are plaited (*inflexa*), when they form an angle or fold projecting at their inferior part, as in the *Tellens*. Each valve, regular or otherwise, may really be compared to an univalve shell, in general very flat and covering the animal, but instead of being placed on the back of the animal is situated at its sides; there must, therefore, exist a summit and a base, an external convex, and a concave internal surface. The summit of a bivalve shell is termed the beak, or tip (*apex*), and it is from that point the growth of the shell commences. Considering its general position, always bearing in mind the animal which it covers, it is oral or buccal (*oralis*), when it is at the anterior extremity of the valve, which is rarely the case; an example, however, is exhibited in the spondylus, oyster, &c., and this is commonly called the spur or heel. It is dorsal (*dorsalis*), when it corresponds with the back of the animal or the superior margin of the shell, which is ordinarily the case with shells in general; in this case it may be *antero-dorsal*, when placed more forward than backward in the length of the valve; *medio-dorsal*, when in the middle; and *postero-dorsal*, when more backward than forward; anal or posterior when situated at the opposite extremity to the mouth, as in the *Terebratula*, *Lingula*, &c.

It is also from the relative position of the summit of the bivalve shells, that the characters are indicated by equilateral, sub-equilateral, or in-equilateral. A valve is said to be equilateral when the cephalic summit is exactly in the middle of the side on which it is placed, so that a perpendicular line drawn through would sub-divide it in equal portions, as is seen in the *Pectens*. Sub-equilateral, when there is only a slight difference in its position, either backward or forward. In-equilateral, when the difference between the two sides is more considerable, and consequently the summit becomes either antero-dorsal or postero-dorsal. The direction of the summit offers also some characters designated by particular terms; it is the most frequently a little curved or inclined forward, but it is also sometimes entirely vertical, or in the direction of the diameter of which it forms one extremity, and it is more rarely inclined backward; and in some species the summit has a tendency to assume a spiral form, as in univalves. It is variously named in scientific terms according to its being—ear-shaped, spiral, recurved, entire, callous, &c., for which, as before, we refer to the treatises on this subject. The external face of the valves offers several characters important to know, it is either convex or flat, which needs no explanation, it is full (*plena*), as in the *Tridacna*; bordered (*marginata*), when furnished with a projecting rim; toothed or serrated (*dentata*), when the circumference is furnished with what may be here termed teeth, as in the *tridacna*, cordiform, crescent-shaped, lanceolate, oval, oblong, superficial, &c., according to its resemblance to a heart, as in some of the species of *Venus*, &c. The internal surface of the valves presents also many characters deserving attentive consideration, but not easily described without illustrations, that would here occupy too great a space. The valves are right hand or left, according to the position of the animal as we

have already placed it; they are equivalve, when exactly corresponding in size, depth, and general form, as exists in most of the bivalves; sub-equivalve, when the difference between the two valves is not very considerable, as in certain species of *Pectens*; in-equivalve, when there is a very visible difference, either in the form, size, or other particulars. Linnæus has named the smallest and flattest valve the operculated one, as in the *Gryphæa*; but, for the reasons we have stated, it is mis-applied. The valves of bivalve shells, placed in opposition to each other, often touch at every point of their circumference, in which case they are termed closed (*clausa*), when not thus everywhere united, they are said to gape (*hians*). In the first instance, the closing of the valves may be simple by approximation, or they may be shut by the insertion of the opposite notches, grooves, teeth, &c., with which many are furnished. In bivalves having a partial opening in the circumference of the valves, more or less considerable, it is, for the most part, only posterior, or both anterior and posterior to a certain extent, as in the *Solens*, the *Pholas*, and many other species; sometimes it is inferior, and more or less anterior or medial, as in the *Arks*, *Muscles*, &c., and it is sometimes anterior, and superior, as in the young examples of the *Tridacna*. Another point of view, perhaps more important than most of those which we have described, is the peculiar mode in which the valves of shells are united to each other; these are three in number, one belongs exclusively to the animal, depending upon the use of certain muscles or bundles of muscular and elastic fibres, which are carried transversely from one valve to the other; these leave an impression on the internal surface of the valve, the study of which has been pointed out as important in deciding the genus of a mollusc, without any previous knowledge of the animal. The second mode of union also belongs properly to the animal alone, and although much less than the first, it leaves also its indices, or traces, very perceptible in the excavations of different forms in which it is attached, this is named the ligament (*ligamentum*); it consists of a mass, more or less considerable, of horny fibres, elastic, and covered with an epidermis, carried from side to side of the valves. Some bivalve shells are met with entirely without a ligament, properly so called, as in the *Orbicula*, *Pholas*, and others, in which it is not distinct from the general epidermis, as in the *Pinna*, but most frequently bivalves possess a ligament; this is simple (*simplex*) when there is only one, as in the *Venus*; and the greater number of bivalves, double (*duplex*), when there are two ligamental processes, the one posterior, as in certain *Tellens*, whence they are called amphidesma, or when there exists one external, the other internal, as in the *Mactra*. Multiple (*multiplex*), when there is a series more or less considerable, as in the *Perna*, and, perhaps, even in an inverse position, in the *Arks*. The position of the ligament, with regard to the summits, is thus defined: anterior, when placed in front of them as in the *Donax*; medial, when immediately beneath the apices; posterior, which is the most usual, when behind the summit; antero-posterior, when both backward and forward, occupying an extended space, as in the *Arks* and their congeners. The position of the ligament, as it is externally visible or not, distinguishes it into external (*externum*), when visible, which occurs with most bivalves; deep (*profundum*), when it is so deeply placed, that it is scarcely perceptible on the outside;

as in the *Venus*, zig-zag; internal, when it is positively altogether concealed, as in the *Mactra*, *Crassatella*, and to a certain extent in the oyster. As to its being flat, round, short, long, &c., it speaks for itself.

The last mode of connexion between the valves of shells is called the hinge (*cardo*), which may be defined as a particular arrangement of differently formed prominences, or cavities on each valve corresponding reciprocally with each other. Authors call that the thickest portion of the circumference of the valve in which most frequently these cavities or teeth are situated; this is the cardinal margin (*margo cardinalis*); the cardinal blade or ridge (*dissepimentum cardinalis*) is that portion of the edge which exhibits the teeth. Examining shells with regard to this arrangement, they are called toothless (*acardis*) when no trace exists of cavities, projections, or ligament, but of these, perhaps, only one example can be offered, it is the *Lingula*. When there is only one protuberance on the part termed the hinge, more or less elongated and irregular, it is called callus (*callosa*). When the cardinal ledge, instead of being vertically placed, as is in most instances the case, is horizontally enlarged by a projection fitting into a corresponding cavity, placed beneath the summit of the other valve, or under a similar projection, Linnæus called it *dens vacuus* or *depressus*; but erroneously, not being a true tooth, and only serving for the insertion of the ligament. In all other shells provided with a true hinge, it is necessary to observe if it is exactly similar on each valve, in the first instance, it is termed therefore similar (*similis*), and in the second dissimilar. The position of the hinge, generally considered, also requires some particular denominations, which are nearly the same as applied to the summits; oval, dorsal, anal, &c., as they may be situated on the back, posterior, anterior, &c. In the different portions of the hinge it is formed complete by means of eminences and cavities, the one called teeth, the other indentations (*fossula*); when the hinge is formed by one tooth or protuberant portion, as in the *Mya*, it is called the *Sinus* by Linnæus. These eminences or corresponding cavities with relation to the summit may generally be denominated in the same manner as the entire hinge. The cardinal teeth (*dentes cardinales*) are those placed immediately beneath the summits, and are usually the principal ones. The lateral teeth (*dentes laterales*) are, on the contrary, those of less importance, and more or less separated either before or behind the summit; those placed nearest to the lamella are called *dens anticus*; and the *dens posticus* are those on the side of the ligament or shield, thus reversing the Linnæan position. The direction in which these teeth are placed distinguishes them into vertical, oblique, longitudinal, divergent, or convergent. In the *Cyrena* they are nearly vertical, oblique in the *Venus*, longitudinal in the *Cardita*, divergent or convergent, according to the point of view taken from the summit, as in the *Mactra*. The mode of junction of these teeth establishes the terms inserted (*intrans*), which is where one penetrates between two others. Alternate (*alternus*), that which crosses another obliquely, as in the *Cardium*; articulated (*insertus*), when the hinge formed by them is produced from a reciprocal arrangement inverse on each valve, as exists in the greater number of bivalves. The particular form of the teeth is expressed by lamellar (*lamellosa*) or longitudinal when they are very long; and much compressed if short or thick; when on the contrary, straight

or curved, simple or bifid, smooth or striated, according to circumstances, too obvious to need further explanation. The number of teeth is sometimes important to observe, though they are not always uniform in the same species of molluscs. In multivalve shells, according to the modern system of classification, such as were included by Linnæus from being more or less complete tubes, which might accompany or even entirely envelope the two valves of a bivalve mollusc, were by him sometimes called accessory pieces, have been excluded, and only those completely visible are so called. Multivalve shells are constantly produced by animals which may be called intermediate between the mollusca and the entomozoria, while those of the *Pholas*, *Teredo*, &c., are true malacozozaria.

They are also very few in number, and it is scarcely necessary to dwell particularly on the denominations of their parts, as the greater portion of them are the same as those of bivalve shells; they may be called with regard to the position of their parts or valves, articulated, lateral, ante or post lateral, dorsal or ventral, but one group established by Lamarck, under the name of coronal or sub-coronal molluscs, requires a more particular notice. In these the portions constituting the shell being disposed regularly round a common axis, are firmly knit together by their margins, so as to form a complete cavity or space in the centre, closed or open inferiorly, and shut superiorly, by a small number of pieces of various forms, the total of which is called their operculum, or lid; the form and number of principal pieces, as well as those thus termed the operculum, varies so much that they merit distinct terms to designate them. The support (*basis*) is always monotomous, and may be simply membranous, irregular, or patelliform, in which case it may easily be confounded with the *Limpet*. The terminal or operculated portion is at least ditomous, because it is always in pairs and symmetrical, but then each lateral piece is most frequently divided into two valves, the one dorsal, the other ventral, according as they correspond to the analogous coronal pieces. This operculum is called articulated, when it evidently touches the coronal portion; it is inarticulated when entirely surrounded by the membranous portion of the aperture. The principal portions of these shells have occasioned their being called coronal, because they form a sort of crown round the body of the animal. The number of pieces forming what is termed the operculum usually amount to six, but they vary much sometimes, being only four in the usual state of these valves; each is divided on its surface into two triangular areas, the one in relief, the other hollow. And in the interior of these it is found that they are doubled in their superior or anal half by a vertical plate or separation, the extent and form of which is very important in distinguishing this singular species of shell. A reference to the article *Balanus* will also point out some other peculiarities not yet satisfactorily explained. Upon this subject, as well as many others connected intimately with the study of the science of conchology, we have been constantly tempted to enlarge; but a want of space must preclude us from dwelling longer, as a volume might be written, filled with ingenious hypotheses, and well-grounded deductions; our object, as has been more than once stated, being to induce a deeper research in others, rather than to broach our own opinions, or to write a voluminous treatise on the subject. So numerous are the pub-

lications adapted to every stage of the study, that those who have leisure to pursue it may take it up in any part of its progress. We flatter ourselves that we have, as concisely as the nature of science will admit, given an outline likely to prove serviceable to the student, without entering abstrusely into that portion of it which can only be interesting to the more finished naturalist. Having, in this place, confined ourselves more particularly to shells, as objects detached from their parents, much more remains to be said of them as properly connected with the animals; and this will be attempted under the articles MOLLUSCA and MALACOLOGY. We will now proceed to give a rapid sketch of the history of the science, or at least that part of it which includes the arrangement of *shells alone*, without any or very little reference to the animals. In which point of view, nearly all the naturalists of former times have written, and it may not be found useless or uninteresting to name the most celebrated authors, beginning from a very remote period of time down to that at which the science has assumed a new and higher order of claim to the attention of mankind.

That the study of natural history, and Conchology as a part of it, was not deemed beneath the notice of philosophers and statesmen in the enlightened ages of Greece and Rome, is proved by the valuable works still extant, the earliest of which is that of Aristotle, who flourished 322 years before the birth of Christ. It may be deemed a precious monument of accurate observation, and justly entitles him to the immortal name of the father of natural history. Like every other of his writings, this branch exhibits profound wisdom, and, even to the present day, his outlines of a systematic arrangement have been followed, and many of the genera of shells retained by succeeding authors. He first established the two great natural orders of univalves and bivalves, viewing shells, precisely as they are now considered, to be testaceous bodies, consisting of so many pieces or parts. The first were therefore termed *Monothyræ*, the second *Dithyræ*. To these he added a third order, in which were included the turbinated shells. Of these three orders he commenced a generic arrangement, distinguishing between their terrestrial or aquatic habitats, and even the immobility or locomotive power of the different species. These he separated into the *cinetica* or *acineta*. When we consider the period at which this great man existed, and the isolated nature of his labours, comparing them with the information he possessed in natural history, we may be truly astonished at his sagacity and wisdom. Though the acquirement of human knowledge is slow and progressive, Aristotle's Ostracodermata presents a valuable scheme of shells, and the sound well defined basis of all subsequent systems. Nor was the Macedonian philosopher the only great man of antiquity whose mind was alive to the study of natural history, and whose more important labours were diversified by its inviting charms. Pliny, Ælian, Athenæus, and Cicero, were each of them enthusiastic naturalists, and have left valuable proofs of their accurate observation of nature's productions, particularly in that branch we are now treating of. But this study, like all other liberal pursuits, was neglected in the darker era that succeeded, at least no evidence to the contrary has survived to this period; but in after ages, when the mists of Gothic ignorance, which had so long obscured the western horizon, dispersed,

the light of science dawned, and Conchology not only revived, but was encouraged by men eminent for learning and a superiority of mental acquirement, the admiration and envy of past centuries. Pliny, who lived in times more favourable to the cultivation of science (A.D. 80.), added but little to the information he derived from the writings of Aristotle. He certainly has added considerably to the number of species at that period described. The shores of the Roman empire, the Mediterranean, and Red Sea, presenting a rich field for the enterprising conchologist, he described, with great fidelity, the form and external aspect of shells, in which he has been followed by succeeding naturalists. But his arrangement was unphilosophical—his descriptions unsatisfactory—and he discovered but little matter important to the science beyond that which had long before been pointed out by Aristotle. Passing over the dark ages succeeding Roman greatness, in which science was degraded and ignorance deified, we find, to the end of the fifteenth century, little to instruct or interest us on this subject. Vicentius, in 1494, treats of the genera *Murex*, *Ostrea*, and some *Silices*, but without any systematic arrangement; and he has done no more than borrow from his predecessors, adding most largely from the superstitious absurdities of his days. In the sixteenth century, Belen, Rondeletius, and other authors, added something more to the information transmitted from the earlier ages. Their works, however, merely described new species, or pointed out what they considered a more natural arrangement of shells, many of them, however, venturing upon a general systematic classification materially different from the first outline sketched by Aristotle. We will therefore come to that period when Daniel Major may be considered as the first author who really occupied himself with a distribution of shells into a systematic form. This will be found in an Appendix to a Treatise on the Genus *Purpura*, by F. Columna, in the German language, under the title of *Ostracologia in Ordinem Redacta*, printed at Kiel in 1675. This appendix contains synoptic tables pointing out a natural association of genera established on the species observed by Columna, and consequently very few in number. To Major we are indebted for the division of univalves and multivalves, among which he places the bivalves.

In 1681, our countryman, Grew, in his *Museum Regium*, a descriptive catalogue of the Royal Society's collection, has published a systematic and synoptic table of the genera of shells, in which he includes all the testaceous envelopes of animals, and, without positively employing the present received terms of the science, established divisions of the single, double, and multiple shells, corresponding with our univalve, bivalve, and multivalve genera. In the first, he separates such as are rolled on a fictitious axis from those not so constructed; these are again divided into the species whose spires are visible or not, as in the *Nautilus*, *Cowry*, &c. By this arrangement it is obvious that Grew distinctly pointed out those clear indications of animal structure forming the greater number of our present genera.

Sibbald, in 1684, in his *Scotia Illustrata*, goes back nearly to the divisions of Aristotle, principally considering the habitat of the shells, dividing them into terrestrial and aquatic, and the latter into marine and fluviatile species.

Lister, in 1685, still followed a similar arrangement; but, having the advantage of examining a far greater number of shells, his treatise is consequently more complete. His work, *Historiæ sive Synopsis Methodica Conchyliorum libri quatuor*, appeared in parts, and continued down to 1688. It contains, besides, a great number of plates, faithfully drawn and engraved by his daughters, the introduction of a distinction between the equality or inequality of the valves. He also appears the first to have attached a proper importance to the consideration of the hinges of bivalves.

Tournefort, an eminent French botanist, who died in 1708, attempted to facilitate the study of shells, which he designated under the general name of *Testacea*, defining them as the envelopes of certain animals possessing the hardness of a tile, or baked earthen vessel; but his method was only known for the first time by a work of Gualtieri's, published in 1748. Tournefort substituted the names of *Monotoma*, *Ditoma*, and *Polytoma*, for those of the present day. Among the *Monotomes* he established the distinction between the univalves, properly so called, and the spirivalves and fistulivalves, and his generic characters are considerably guided by the form of the aperture. In his class *Ditoma* he is said to have been the first to establish a division between the bivalves that closed perfectly (*Clausæ*) and those which partially gaped (*Hiantes*). He also paid attention to the position of the hinge. In his *Polytoma* he, however, confounds the *Echini* and *Balani*.

Rumphius, in 1711, described a considerable number of shells from the Indian seas, but he did not add much to the science of Conchology. He did not even separate the bivalves from the multivalves; and with respect to the univalves, he considered them simple or turbinated, as distinguished by Aristotle. He, nevertheless, indicated some well-defined divisions, such as the *Strombus*, *Voluta*, and the porcelaine genera.

Lang, in 1722, proposed a new but partial conchological distribution, merely treating of marine shells; but notwithstanding the pompous enunciation of his work, which is too long to be here inserted, he added very little to Lister's arrangement beyond examining the equality or inequality of the valves, and the relative positions of the summits. He also paid rather more attention to the form of the apertures in univalves, and of the summits of bivalves, in these he likewise established a division of anomalous species.

J. Ernest Hebenstreit, in 1791, published a dissertation, entitled, *De ordinibus Conchyliorum Methodicâ Ratione instituendis*, in which there are but few important novelties. He, nevertheless, among the univalves, pays more attention to the spine than his predecessors had done; and in the bivalves, his first division is characterised by the presence or the absence of the hinge, as then considered.

Phillip Breyn, in 1830, first drew the attention of conchologists to a distinctive character of shells, up to that period overlooked, this was the number of cells or separations in univalves, whence proceed the names *polythalamia* and *monothalamia*.

Gualtieri, an Italian author, in 1742, published a work which still possesses some degree of reputation, from the great number of shells figured. They are, however, but indifferently executed, and fall far short of modern illustrations. As a work of scientific reference, it includes all, or nearly so, that his predeces-

sors had introduced in the way of classification, without adding much improvement or novelty; we shall not, therefore, dwell upon it, but merely observe, that though he indicates many generic divisions, they are not established on a solid basis, and have afforded but little to guide subsequent writers.

D'Argenville, in the same year, published in France the first edition of his work, *De l'Histoire Naturelle éclaircie Dans Deux de ces Parties Principales, la Lithologie et la Conchyliologie*, a work like that of Gualtieri's, much admired for its plates, but containing little scientific improvement to recommend it. In nearly all he has done, Lister's system was his guide, and when he ceased to consult or follow that authority, he has invariably made matters more obscure, though he is most unjustly critical in his observations on that author.

Klein, immediately after D'Argenville, published a work entirely systematic, but without the advantage of good illustrations. His object appears to have been that of overturning and changing all Linnæus attempted to establish; this being unsupported by the reasons of subsequent writers, render his work a mass of confusion and little worthy of reference. He certainly proposed, rather than established, a great number of genera since adopted; but the characters assigned to them were so vague, and so badly circumscribed, that his writings have nearly fallen into oblivion. His classification of the *Echini*, however, merits praise as being the first attempt, though extremely deficient in execution.

Adanson, in 1757, published his voyage to Senegal, and, although the first editions of Linnæus' *Systema Naturæ* had already appeared, we place his information in a point of priority, because it appears quite evident that great naturalist must have derived a considerable portion of his general fixed principles of conchology from Adanson; he also may, more properly, be considered a writer on malacology, since he examines shells, with their animal architects. By this much innovation was introduced into the science of conchology, properly or abstractedly so called in this article. Thus, besides an elaborate study of each of the parts of shells, and a description of the characters, he may be said to have formed a distinct system for each. Among other novelties in confirmation of this he divides bivalve shells according to the number of their muscles, or their attachments; and above all, he has introduced the consideration of the operculum, an important feature of the science, up to his time altogether neglected, or nearly so, by subsequent authors. From this consideration, he established in the *Helices* two marked sections: the first, univalve snails; the second, operculated species, which he considered, though very erroneously, as forming the gradation to bivalves. He appears also to have been the first who classed the *Patella* with the *Chiton*, his section of multivalve conchs containing only the *Pholas* and the *Teredo*.

Linnæus, in his first edition of the *Systema Naturæ*, proved that he was not master of this part of natural history; but in the edition following Adanson's work, he exhibited the possibility of applying the same principles which he had discovered and so advantageously employed in botany. He, nevertheless, created no very novel consideration in the first divisions; nor, indeed, in the secondary ones, since he divides shells into multivalves, with which he begins, and in which he places the *Chiton*; bivalves and univalves, after-

wards sub-divided into turbinated or not turbinated; but he has the lasting merit of having introduced, in the description of their characters, in their circumscription, and in the creation of a conchological language, that brevity and clearness which will ever entitle him to be considered the model and master of systematic naturalists, from which nothing can obviously detract, except the bad taste and unaccountable feeling which but too frequently marks his nomenclature—setting modesty at defiance, and making greybeards blush.

About this period Martini commenced his gigantic book, which was continued and completed by Chemnitz in 1788. This we consider rather as a collection of the figures of shells, than as a true system of conchology, the arrangement partaking of Gesner and Lister's plans, with regard to the first divisions; and the others formed from the habitat of the animals, he nearly follows the Linnæan system, and his great divisions may be considered simple, and not breaking their natural gradations in any very remarkable degree. As a work containing a greater number, and, generally speaking, more correctly drawn illustrations of shells, nothing combining these united advantages has ever yet appeared; its great price, however, will ever render it a work of luxury more than utility.

Dacosta, in 1776, published an original, and, it may be said, true system, under the title of Elements of Conchology. It differs evidently but little from that of Linnæus, though he attaches more importance to the predominant characters drawn from the form of the aperture in turbinated univalves, and the hinge of bivalves; he is the first writer who suggested the propriety of changing many of those terms used by Linnæus, of which we have already pointed out the indecency; he has also considerably augmented the number of genera of that naturalist, each of which are illustrated by tolerable figures; but though his work may be deemed highly instructive, he has not introduced into the science any very strikingly new consideration.

We pass over in silence several authors, such as Müller, Born, and others, who have added little or nothing to the science of conchology, in our present view of it. Those of them who have examined shells with reference to the animal, will be noticed hereafter, and we then come to the French School of Conchology, in which it appears to us more has been done than in any other, towards raising the study of this interesting portion of creation into its well-merited rank of natural sciences; and we must be permitted a slight digression from the immediate article under consideration, to state, that although we are not wedded to the system of any one author, blind to the faults of all, or insensible to the improvements of time, we must, nevertheless, adopt some rule of conduct, some guide for our opinions, and we do not hesitate in preferring a system, matured as it now is upon the admirable model furnished by Cuvier, and other great naturalists, his disciples: like every human effort it is incomplete, often erroneous, but as a whole, the most perfect yet constructed; and, from being founded on the broad basis of truth and common sense, will last to the end of time, becoming more confirmed by every day's experience of its correctness.

Brugnière, in 1792, is the first author we shall name, as having taken the lead in forming the modern science of Conchology. We must all along be understood to allude to it, more particularly as relative to the consideration of shells as isolated bodies, the view we have confined ourselves to in this article.

Brugnière closely followed Linnæus, but it is due to him to acknowledge that he has much more clearly characterised and circumscribed the genera, which has necessarily led to considerable increase of their number. Death having deprived the world of the benefit that would have resulted from his labours early in the commencement of his scientific career, the small number of genera he lived to describe will prove the justness of his reasoning. His characters were well defined, clearly explained, and, what is extremely important in this as well as every other study, they are perfectly consistent with each other. He may be considered the first naturalist who has introduced into conchology that exact precision of detail so necessary to be observed, particularly with reference to those minute indications required in a comparison between recent and fossil shells; in other respects he does not claim much praise as having introduced any very marked improvement in the Linnæan system.

De Lamarck improved upon his friend Brugnière's method considerably, not only by considering the shell as a part of the animal constructing it, according to the opinions of Guettard, Adanson, Geoffroy, Müller, Poli, Cuvier, De Ferussac (father and son), De Blainville, and others, but by the great number of new generic divisions, a more rigorous terminology; and by the introduction of the muscular impressions in bivalve shells, as the base of one of their principal divisions, which, in 1810, was adopted by Ocken. Lamarck, nevertheless, fell into the error of classing the *Chiton* with the *Patella*. In general it may be observed that he has entirely departed from the divisions of previous conchologists, established upon the number of pieces composing the shell; and that it is rather the combined form of the shell which he examines, to establish his four first divisions into sub-spiral, cardiniferous, sub-coronal, and vermicular; and, in fact, he could no longer admit the univalves, bivalves, and multivalves, since he places the *Chiton* amongst the sub-spirals, which certainly no one wishing to arrange a collection of shells would have thought of. In this arrangement, Lamarck has, *if possible*, placed shells too closely in scientific connexion with their animal inhabitant, which, though it renders the subject far more interesting to the philosopher and anatomist, occasions the science to become more difficult to those who have the same motive for studying it, and merely look at it as a mental relaxation from other worldly pursuits. During the period that was occupied, in bringing to perfection and publishing Lamarck's system, other conchologists followed Brugnière's extended view of the Linnæan system, and Donovan, Montagu, Bosc, &c., published their arrangements.

Denys de Montfort, in 1808, brought before the public his Systematic Conchology, including only the univalve shells; but he carried his generic subdivisions to a ridiculous excess, by wishing too narrowly to define extremely minute characters; this, doubtless, arose from his having been the first author who thought science demanded the description of microscopic shells; but though his work, were it generally useful, might easily be modified, it is not considered an authority at this time. Many of his genera are, nevertheless, adopted.

De Blainville, a French naturalist, and an excellent anatomist of Cuvier's school, published his first classification of shells in a memoir read at the Philomatic Society in 1812. This was founded on a reference to

the animals, and not their simple coverings; but he has the merit of having, for the first time, introduced a consideration of shells in a new point of view, that of forming the essential protection of the organs of respiration, from whence followed, to a certain extent, the general form and position of them; and thus, by combining as it were the double function of the shell and the animal, to be able to pass easily from the one to the other, by calling the attention to the indications of a new character, founded on the symmetry or non-symmetry of univalve shells, with regard to the respiratory organs. He also replaced the *Chiton* with the univalves, and in many other instances has adduced very satisfactory reasons for having re-united many of the genera of Lamarck and other naturalists, improperly and needlessly sub-divided by them.

This brief sketch of the progress of conchological study, as a science, must be considered extremely incomplete, since we have professedly named only a small portion of the labourers in that field, and only such as have in some degree attempted a new systematic arrangement of shells alone: to have enumerated each new idea, each novel alteration in the progress of time since the days of Aristotle, would have occupied space allotted to more interesting matter, and could not have conveyed any useful information, particularly to the scholar; to have given a mere catalogue of authors, and the various views they have taken on the subject, for the same reason is useless, and as Conchology in future must be combined with a reference to the animals constructing shells, the system will be described more amply under the article MALACOLOGY.

The object of this work is to point out briefly all that may be deemed solid information on every branch of natural history, and not to enter into controversial points of opinion, or to wage war against those with whom we may have the misfortune to differ. Every man has, doubtless, a right to his own set of ideas, but it is deeply to be regretted, when his ignorance, or its offspring, vanity, induces him to question with acrimony another's different view of the same subject; to split hairs with cannon balls, and to write all men down as asses, who presume to differ with him in opinion. This, unhappily, but too frequently is exhibited by modern naturalists, and it is the more remarkable, since the study of natural history should lead to every good feeling of human nature—unite mankind in one common cause, and contribute to one great end—that of adoring the Author of all these marvellous productions; the least of which, if properly received, would humble the pride of the most arrogant of mortals; by proving to him, that the ingenuity of ages can only produce clumsy imitations of anything bearing the imprint of Almighty wisdom.

CONDYLURA. A genus of mammalia, belonging to the insectivorous division of the order *Carnassier*, and, in general habits, bearing some resemblance to the moles, but differing from them in many particulars. The most striking of the external peculiarities is their tail, from the appearance of which the genus has obtained its name. It is formed with a series of nodes or enlarged round protuberances (*condyles*), which give it some resemblance to a necklace of beads.

The characters are: six incisive teeth in the upper jaw, of which the two in the middle are very large, bent into a sort of spoon-shape on their inner sides, and with their cutting edges a little oblique; the two external incisors, in this jaw, are conical, and bear

some resemblance to canines. There are four incisors in the under jaw, which project forward with a curve, and give a sort of spoon-shape to the exterior part of that jaw; also, to each side of the upper jaw there are three false molars formed, each of two plates of enamel, and having pointed tubercles on their inner edges, and a groove on their outer. There are four false molars in each side of the lower jaw. The canines in the upper jaw are large and strong for the size of the animal, but those in the lower are very small. They have no appearance of external ears, and their eyes are remarkably small; their fore-feet are short and broad, with five toes upon each, furnished with claws well adapted for digging in the ground. The hind-feet, which are longer and more slender, are also each provided with four toes.

This genus of animals is understood to be peculiar to North America, and in its habits to bear a very considerable resemblance to the moles of the eastern world, that is to say, they spend the greater part of their time under ground, and are understood to subsist chiefly upon earth worms, earth insects, and larvæ. Two or three species have been mentioned, but only one is known with certainty, and of its manners we know but little.

Star-nosed Condylure (*Condylura cristata*). This is the *Sorex cristatus* of Linnæus, but it is more nearly allied to the moles than to the shrews, and therefore, the name is inapplicable. The knots on the tail and also the very remarkable form of the termination of the muzzle, readily distinguishes this from any other animal. The muzzle is very long, supported in the centre by an axis of bone, in the same manner as the snout of a pig, and like that, it has the nostrils central in the extremity, so that we may conclude that its sense of smelling is of considerable service to it in the finding of its food; but the extremity of the snout is very different from that of any other animal. It is in the form of a star, consisting of cartilaginous rays which are rose-coloured, have their surfaces granulated, and are about twenty in number; two on the middle of the upper part and four on the under, are much longer than the rest. All the points of which this star-like rose is composed, are moveable at the pleasure of the animal; but from the peculiarity of their form, we may naturally suppose, that this description of digging instrument, though it may make its way faster than the entire snouts of other digging animals, cannot force its way so readily through compact mould, and thus, the animal is adapted to those alluvial deposits in the American forests, which are formed rapidly, consist in great part of leaves, and are very spongy in their texture. It is possible that some of the elongated filaments may assist the animal in feeling for its food underground: but we are not so well informed of its habits as to be able to decide upon particulars.

The feet bear some resemblance to small hands, they are broad, naked, and covered with scales; and the nails, though longer than those of the mole, are more slender and not so trenchant on their under sides, which farther shows that this animal is adapted for making its way through softer soil than that with which our moles have to contend. This is still farther indicated by the structure of the hind feet, which are long and slender, differing in form from those of most other of the smaller burrowing animals, whether of Europe or any other part of the world. All the phalanges of the hind toes are free, so that the sole of

these feet consists of the metatarsal bones only. This structure of foot enables the animal to spread out its hind toes till they are as wide apart from each other as those of a free-toed bird; but whether the animal uses the extensive resistance which it can obtain by this means, in pushing through soft earth or through tangled vegetables, has not been ascertained. The tail is remarkable for having transverse folds of the skin, corresponding to the different vertebræ, and in the intervals, between those folds, there are long hairs more thinly set than in any other part of the body. The colouring of the fur upon the body is nearly the same as that of the common mole, and it is glossy, and difficult to be soiled or wetted while the animal is alive; but its texture is not so delicate as that of the fur of the European mole. The whiskers do not spread out to the sides as in most small animals, but project forward. On the feet there is a large membranous scale on the inner surface, and a few scattered hairs on the outer. In its general form this animal indicates more activity in motion, though probably less strength in proportion than the mole; but its manners are so imperfectly known, that no very good account of its economy can be obtained. It is not large, being about four inches long in the body, and with a tail about half that length.

Condylura longicaudata. This species is still less known than the former; it inhabits the northern parts of America, but whether exactly the same kind of places as the other is not said. It is without the nasal crest; the tail is rather longer than half the body; the fore feet are similarly formed to those of the moles, but the hind feet are long and slender. The feet are scaly, thus indicating a digger in the ground, an inhabitant of watery places, or both.

The time of pairing, the period of gestation, the number of young, the state in which they first appear, the length of time that they are suckled, their age at maturity, the length of their lives, and all of what may be termed their domestic history, is entirely unknown; neither are we able to tell, with any certainty, what is their principal function, or the importance of that function in the general economy of nature.

CONDOR. See VULTURE.

CONIA (Blainville), *Asemus* (Ranz), a genus of molluse, separated from the family balanides in consequence of a particular combination of the number of pieces forming the tube. The shell is conical, depressed, the coronary part formed of four pieces only, more or less distinct, nearly equal, and usually striated from the summit to the base, with or without distinct areas. The support is flat, very thin, or altogether membranous. The operculum articulated, pyramidal, composed, as in the balani, of two pieces on each side, moveable, or as it were soldered to each other.

The genus has been subdivided into the species whose valves are pectiniform, with the areas and the divisions very distinctly marked. The second division includes all those in which the valves are but little or not at all distinct, and without any traces of areas. The animal is precisely the same as that of the balanus.

CONIFERÆ. The fir family. A natural order of dicotyledonous plants, containing twenty or thirty genera, and nearly two hundred known species.

Considerable discrepancy of opinion existed for a long time among botanists in regard to the structure of the coniferæ; but the researches of Richard and Brown have dispelled all difficulty on the subject,

and have enabled us to comprehend fully the organisation of this most interesting family. The order occupies a place intermediate between the cellular and vascular plants. To the former it is connected by means of *Lycopodiaceæ*, with which it agrees in the aspect of the stem and leaves, and in the nearly total absence of spiral vessels; while it is connected with the latter through the intervention of the oak, willow, and birch tribes, with which it agrees in having an ammentaceous inflorescence. It bears a very strong affinity to *Cycadeæ*, resembling this family in the form of its naked ovula, in its mode of inflorescence, in the arrangement of the veins of the leaves, in the imperfect formation of the spiral vessels, and in having the vessels of the wood perforated by numerous holes.

The name *Coniferæ* is derived from the fruit, which is in the form of a cone. The essential characters of the order are: Flowers, monœcious or diœcious: *Sterile flowers*, monandrous or monadelphous, each floret consisting of a single stamen, or of a few united, collected in a deciduous catkin about a common rachis; anthers two or many-lobed; pollen large: *Fertile flowers*, generally in cones, sometimes solitary; ovary in the cones spread open, and having the appearance of a flat scale destitute of style or stigma, and arising from the axil of a membranous bractea; ovules naked, in the cones in pairs on the face of the ovary, having an inverted position, in the solitary flowers erect; fruit consisting either of a solitary naked seed or a cone; seeds with a hard, crustaceous covering; embryo in the midst of a fleshy and oily albumen, with two or many opposite cotyledons.

The plants belonging to this order are resinous trees or shrubs with branched trunks, and linear, rigid, entire leaves, furnished with parallel veins, and sometimes sheathed at the base. They are found in various and very different parts of the globe; some inhabiting the cold regions of the north, and others growing in the hottest parts of the Indian Archipelago. They abound in the temperate climates of Europe, Asia, and America, and many species are furnished by the Australian continent.

The order has been divided into three sections: I. *Abietineæ*, the pine tribe, including the genera *Abies*, fir or spruce; *Pinus*, pine; *Larix*, larch; *Cedrus*, cedar; *Cunninghamia*, *Dammara*, *Araucaria*, &c. II. *Cupressineæ*, the cypress tribe, comprehending the genera *Cupressus*, cypress, *Juniperus*, juniper, *Thuja*, &c. III. *Taxineæ*, the yew tribe, including *Taxus*, yew, *Ephedra*, *Podocarpus*, &c.

All the species of this extensive family are raised from seeds. The cones are gathered in winter and exposed to the sun, or the gentle heat of a fire or kiln. In this manner the scales are opened, and the seeds easily taken out. The cones of the Scotch pine, the common spruce and larch, require kiln heat; while those of the Weymouth pine, silver fir, and balm of Gilead fir, give out their seeds easily without the aid of artificial heat. So long as the cones are kept close the seeds remain uninjured, and they ought not to be opened long before the seeds are sown, otherwise germination is apt to be prevented. The seeds are sown in the months of March and April, in soft rich soil. They ought at first to be screened from the sun and protected from birds. They require a covering of earth, varying from one-fifth of an inch to an inch and a half. For the spruce fir one inch is required, for the silver fir, and balm of Gilead fir, the depth of soil varies from one-half to three-

quarters of an inch, while for the American species one-fifth only is requisite. The seeds of most of them, except the stone pine and a few others, come up very soon. They are thinned and put in rows at the distance of four or five inches, and three or four in the row. After being a year in these rows, they are removed to others two feet distant from each other. After being two years in the seed-bed, and having attained the height of six or seven feet, they are finally planted out, and great care is requisite in the removal not to allow the roots to be long exposed, for though the plants are hardy when grown up, they are very tender when young. Fir plantations should be regularly thinned from the time the trees are six or seven feet high, until they attain the height of twenty or thirty feet. At this time the trees, if they are Scotch, spruce, or silver firs, ought to be at least twenty feet distant from each other. Larch firs require more shelter, and ought to be a little closer. Firs, in general, require plenty of room, in order that their branches may expand fully. They cannot be pruned, on account of the large quantity of sap which they contain, and which flows freely from the slightest incision, weakening the tree much, and sometimes stopping its growth for several years.

Various resinous products are furnished by the fir, pine, and larch tribe. They may be divided into—1, those which are yielded by spontaneous exudation, such as Briançon manna, &c.; 2, those which are got by making wounds into the wood through the bark, as the various kinds of turpentine; 3, those obtained by decoction, as the essence of spruce, and 4, those procured by fire, as tar and pitch.

The common oil of turpentine of the pharmacopœias is procured by distillation, and is the product of several species of pine. It is a transparent, limpid, volatile fluid, having a hot pungent taste, and a powerful odour. It is highly inflammable, and is lighter than water. Its properties, in general, are of a stimulating nature, and it is much used in medicine. It acts upon the bowels, and increases the secretion of urine, imparting to it a smell of violets. In large doses it is particularly beneficial in tape-worm. It is also used in epilepsy and in inflammation of the bowels. When given in large doses, it produces temporary intoxication. Externally it is employed in palsy, nervous pains and spasms, and in burns. It is also said to be useful in checking bleeding. It has been lately employed, with great success, in the process of boring or cutting glass, as it is said that a common awl may be forced through a plate of glass, provided oil of turpentine is kept constantly applied.

The residuum of the distillation of oil of turpentine receives different names according to the mode in which it is conducted. When the distillation is performed without addition, and continued till all the essential oil is driven off, then there remains colophony; but if water is added to the mass while fluid, or thoroughly blended with the rosin by agitation, then we procure yellow rosin.

In procuring tar, a conical cavity is dug in the earth, which communicates with a reservoir at the bottom, and billets of fir are then placed so as to fill the cavity and form a cone above it. The mass is then kindled at the top, and covered over with turf. In this way the combustion goes on slowly, and all the liquefied tar accumulates at the bottom. By boiling the tar for a long time, all the volatile matter is driven off, and a substance called pitch is left.

Tar or pitch ointment is applied externally in ring-worm and various cutaneous diseases. Tar water has been recommended as a diuretic and sudorific. Tar fumigation has been considered beneficial in consumption, by promoting expectoration.

Cedrus Libani, cedar of Lebanon, (*Pinus Cedrus* of Linnæus,) is a native of the coldest parts of the mountains of Libanus, Amanus, and Taurus. In these places the tree formerly grew in large quantities. The forest of Lebanon was famous in the days of Solomon; and in his time cedars were said to be "as the sycamores that are in the vale for abundance." Nowadays, however, cedars are by no means common in Palestine. A few still exist, some of them nine feet in diameter.

The cedar is a large, wide-spreading tree, not so lofty as is frequently represented, and as Milton would make us believe, when he says—

Over head upgrew,
Insuperable height of loftiest shade,
Cedar, and pine, or fir, or branching palm.

The timber of the cedar is very indestructible, and was anciently much used in the decoration of temples. In the temple of Apollo, at Utica, some beams of Numidian cedar are said to have been 1200 years old. This wood was also employed in forming statues; and it is supposed that the famous statue of Diana at Ephesus was constructed of it. The wood was also used in embalming and in preventing putrefaction. The tree yields a saccharine resinous substance.

The cedar was introduced into Britain in 1683; and in some parts of England, as at Witton Park and Zion House, it thrives well. In the Garden of Plants at Paris, there is a fine specimen of the tree which was planted by Jussieu.

The cones of cedar must be kept for a year before the seeds are taken out, on account of the softness of the seeds and the resinous matter with which they are surrounded. The cones are imported from the Levant, and the seeds retain their vegetating powers for many years.

Cedrus deodara, sacred Indian cedar, grows on the high mountains of Nepaul and Thibet, at an elevation of 10 or 12,000 feet above the level of the sea. It is regarded with veneration by the Hindoos, and furnishes durable and valuable timber.

Juniperus communis, common juniper, is common in many parts of Europe. A dwarf trailing variety of it is found on the mountains of Wales, Scotland, and Ireland. It is an evergreen shrub, furnishing a hard, reddish wood, which serves for ventering. Its bark is made into ropes. Its berries are imported in considerable quantities from Holland and Italy. They have a strong, disagreeable smell, and a warm, pungent, bitterish taste. They consist of essential oil and sweet mucilaginous matter. This oil, which is of a green colour, is separated by distillation, and gives the peculiar flavour and properties to Hollands. Gin was formerly made in imitation of Hollands, by the addition of juniper; but it is now made from whiskey rectified on turpentine.

Both the berries and the tops of the juniper are used medicinally. They possess tonic, stimulant, and diuretic properties. These qualities are owing to the essential oil which they contain. An infusion of the tops has been used in dropsy. The juniper is the badge of the clan Murray in Scotland.

Juniperus sabina, common savine, is a low evergreen

shrub, found native in the south of Europe, and frequently met with in gardens. Its leaves have an acrid bitter taste and a strong smell, and the whole plant yields an essential oil, which possesses very active qualities. The general properties of the plant are stimulant and diuretic. It is prescribed sometimes in cases of worms and gout. An ointment prepared from the leaves, of a green colour, and having the odour of the plant, is used as an issue to promote the discharge from blistered surfaces.

Juniperus Virginiana, red or Virginian cedar, is a tree of great size and beauty. It sometimes grows to the height of forty feet, and furnishes valuable timber, which is used for parts of buildings, and other important purposes. It is found in North America and the West Indies. The heartwood is of a red colour, and moderately soft, and is used in the formation of common cedar pencils.

Juniperus oxycedrus, sharp cedar, or brown-berried juniper, is a native of Spain, the south of France, and the Levant, and was used in ancient times in the formation of statues. Its wood furnishes, by distillation, an empyreumatic oil, called cedar oil, which is used as a vermifuge, and as an article of veterinary medicine.

Juniperus lycia yields a gum-resin, similar to olibanum.

All the junipers are raised from seeds, which ought to be sown in a light soil as soon as they are ripe.

Another important genus of this extensive order is *Cupressus*, or cypress.

Cupressus sempervirens, common, evergreen or funeral cypress, is a native of Cyprus and Crete, and grows on Mount Ida. It is common in old gardens, and is often planted in clumps of evergreens. In consequence of the gloomy hue of the leaves, branches of it were formerly placed before the doors of the deceased, and were used at funerals. It furnishes a valuable and durable wood, which resists the attacks of insects, and is used in Crete, Malta, and the Levant for the purposes of building. The tree was planted by the Moors round their palaces, and by the ancient and modern Romans in their villa gardens. The doors of St. Peter's, which lasted from the time of Constantine, for a period of 1100 years, were made of cypress wood. This is supposed to be the wood of which the ark was made, and called in the scriptures Gopher or Shittim wood. Cypress wood was used by the Greeks in the time of Thucydides for the coffins of their eminent warriors, and we find the chests of the Egyptian mummies sometimes made of it.

Cupressus thyoides, white cedar, is a middle-sized evergreen, found native in North America and China. In the United States it occupies large tracts of country, denominated cedar swamps. Its wood is soft, of a red colour, and diffuses an aromatic odour.

Taxus baccata, common yew, is a native of Britain, the northern parts of Europe, and North America. It is frequently cultivated in pleasure grounds, and used to be clipped and fashioned in a most fantastic and remarkable manner. From being considered a lasting emblem of immortality, it was frequently planted in churchyards, and the sight of it is consequently apt to excite gloomy and melancholy ideas. Pennant mentions a yew in a churchyard in the Highlands of Scotland, at the entrance of Glen Lyon, the remains of which measured fifty-six feet and a half in circumference. In Wales and Ireland twigs of the yew-tree are often carried at funerals.

The yew was formerly looked upon as possessing poisonous and deleterious properties, and was said to prove fatal to any one who slept under its shade. Hence it acquired the appellation of "deadly yew." These notions, however, are now found to be totally erroneous. The berries of the yew, which are of a red colour, are quite innocuous, and do not possess the poisonous qualities formerly attributed to them. The leaves, however, are found to possess slight narcotic properties. The wood of the tree is red, hard, and beautifully veined. It is used by cabinet-makers, and was in early times imported in large quantity for the purpose of making bows. It was in those days planted extensively to furnish bows to our warlike ancestors,

Who drew,
And almost joined the horns of the tough yew.

In later times, since archery is less practised, the cultivation of the yew is less attended to.

The tree is propagated by seeds. It is well known as the badge of the clan Fraser.

Thuja occidentalis is the common arbor vitæ of our gardens. It is a native of Canada and Siberia, and sometimes acquires the height of thirty or forty feet. The first specimen of the tree brought to Europe, was planted in the royal garden at Fontainebleau, in the reign of Francis the First. The wood is used in the formation of boats and inclosures, as well as in the construction of houses. In England it is frequently used by turners. The leaves are said to have been prescribed in rheumatism. Another species, *Thuja orientalis*, is found in China. *Thuja articulata*, or jointed thuga, yields a yellow brittle resinous substance, having an acrid aromatic taste, to which the name of sandarach is applied. It is employed as a varnish. This resin is stated by some authors to be a product of the common juniper.

The coniferous or cone-bearing plants found in Australasia are chiefly included under the genera, *Araucaria*, *Dammara*, *Dacrydium*, *Cunninghamia*, and *Altingia*.

Araucaria, or *Altingia excelsa*, Norfolk Island pine, is an immense tree, which sometimes attains the height of two hundred feet, with a circumference of thirty feet. The wood which it yields is not valuable, on account of its want of durability and solidity. Its bark yields a resinous substance. It does not thrive well in the open air in this country.

Species of the genus *araucaria*, similar to this, would appear, by the researches of fossil botanists, to have existed formerly in Britain. *Araucaria Dombeyi* or *imbricata*, is a South American species, the wood of which is valuable, and its seeds are eaten as articles of food when fresh.

Dammara orientalis, Dammar pine (*Pinus Dammara* of Lambert), is a native of Amboyna, and furnishes a peculiar resinous matter. Some say that liquid storax is procured from it. *Dammara Australis*, Cowdie pine, or Kawie-tree of New Zealand, attains the height of two hundred feet, and yields a light compact wood, free from knots. *Dacrydium taxifolium*, or Kakaterro, another New Zealand pine, is said to equal the Cowdie pine in height. The branches of this pine yield spruce.

We have thus endeavoured to describe some of the plants contained in this extensive order. They are of great interest and importance to man, both on account of the valuable timber which they furnish, and

the useful secretions which are procured from them. Woods and forests, both in cultivated and savage countries, consist in most instances of trees belonging to this family. They are remarkable for their size, the rapidity with which they grow, and the majestic appearance which they present. They are almost invariably natives of the northern, although occasionally found in the southern hemisphere, and may be said to supply, by their dense persistent leaves, the place occupied by the evergreens of warmer climates.

CONIROSTRA, one of the divisions into which Cuvier arranges his great order of Passerine birds, and which expresses generally that the bills of such birds are more or less of a conical form, that is, thick at the base, and tapering to the point. For a more particular account of the propriety of using the name, and of the place which the birds hold in the system, see the article BIRD.

CONIUM (Linnæus). Is the well-known and dreaded hemlock. The spotted hemlock of this country is accounted highly poisonous, though it is useful in some cases when applied outwardly. Two of the South American species, namely, the *C. arracacha* and the *C. moschatum*, are both cultivated there for the sake of their large parsnep-like roots, which are useful articles of diet among the natives. The *arracacha* is now under a trial of naturalisation in this country, with the expectation that, if hardy enough for our climate, it will prove an important addition to our stock of culinary vegetables.

CONNARACEÆ. A natural order of dicotyledonous or exogenous plants, containing five or six genera, and between twenty and thirty known species. This family is by some authors looked upon as a distinct order, while by others it is considered merely as a section of *Terebinthaceæ*. It is nearly allied to *Leguminosæ*, from which it is distinguished by the radicle being at the extremity most remote from the hilum. From *Burseraceæ*, *Cassuviæ*, and other terebinthaceous orders, it differs in the total want of resinous juice.

Considered as a separate order, its essential characters are: Flowers hermaphrodite, rarely unisexual; calyx five-partite, regular, persistent; petals five, inserted on the calyx, with an imbricated, rarely valvate æstivation; stamens ten; filaments usually monadelphous; carpels five, one-styled, distinct, sometimes solitary by imperfection; seeds erect, from the bottom of the cell, in pairs or solitary, with or without albumen, often axillate; radicle superior, at the extremity opposite the hilum; cotyledons thick and fleshy in the seeds without albumen, foliaceous in those with albumen.

The plants belonging to this order are trees or shrubs, with terminal and axillary flowers, in racemes or panicles, and compound alternate leaves, without dots or stipules. They are found in the tropical regions of Asia, Africa, and America. Little is known in regard to their properties.

The chief genera of the order are: *Connarus*, *Omphalobium*, and *Cnestis*.

CONOCARPUS (Jacquin). A genus of shrubs and trees, natives of the West Indies and South America. Linnæan class and order *Pentandria Monogynia*, and natural order *Combretaceæ*. Generic character: flowers in a head; calyx pitcher-shaped, five-cleft, and deciduous; stamens five (ten), inserted in the calyx; anthers heart-shaped, two-celled, bursting lengthwise; style and stigmas simple, scaly,

corky, one-seeded. This is called the button-tree in Jamaica, and has been many years in European collections. It thrives in a mixture of loam and moor earth, and is propagated by cuttings.

CONOCEPHALUS (Thunberg). An exotic genus of orthopterous insects, belonging to the section *Saltatoria*, and family of *Gryllidæ* (Leach), or grasshopper, with long slender antennæ.

CONOLITES (Lamarck). A fossil genus of molluscs. The shell is nearly straight, or only slightly curved, the sides very thin, the cavity filled, through its whole length, by a succession of simple chambers, increasing from the first to the last, which is at a great distance from the opening; the siphon is central or marginal. The genus is subdivided into four species, but the distinctions are extremely minute, and considerable doubts exist as to the propriety of separating it from some others of the family *Orthocerala*. Authors have variously named the species, which confirms the difficulty of distinguishing them. De Montfort calls one *Acheloite*, another *Amimomius*, and a third *Thalamulus*.

CONOPIDÆ (Leach). A family of dipterous insects, belonging to the section *Athericera*, having for its type the genus *Conops* of Linnæus, and distinguished by the mouth being elongated into a slender, pointed, and elbowed proboscis. The nerving of the wings is very simple, and resembles that of the domestic fly. The family comprises the genera *Cephenes*, *Conops*, *Zodion*, and *Myopa*, having the body long and narrow; and *Bucentes*, *Prosenæ*, and *Stomoxys* (forming the family *Stomoxydæ* of Meigen and Stephens), having the body short, and very much resembling the common fly.

The structure of these different genera are very diversified, as are also the habits of such as we are acquainted with. The larvæ of conops are stated to reside in the abdominal cavity of the humble bee (*Bombus*), and St. Fargeau states, that he had noticed the conopides introducing themselves into the nests of wasps, so that he supposes that the larvæ of the former, in all probability, subsist upon those of the latter. Latreille also says, that *Conops rufipes* has been observed in a recently developed state, with the wings still soft, to come out of the body of a bombus. An apod larva found in the body of the stone humble bee (*Bombus lapidaria*), and considered by Latreille and others to have been that of the same species of conops, has been made the subject of a valuable memoir by Messrs. Audouin and Lachat, contained in the first volume of the Memoirs of the Natural History Society of Paris. The conops, when arrived at the perfect state, frequent flowers, as do also the zodions and myopæ. M. Robineau Desvoidy has informed M. St. Fargeau, that a larva which he had found in the body of a caterpillar produced a fly of the latter genus.—In like manner the larvæ of *Bucentes*, observed by De Geer, had been reared in the chrysalis of a moth, although the perfect insect, as well as the prosenæ, live upon flowers. The genus *Stomoxys* comprises that tormenting insect which is so often mistaken for the domestic fly, and which does not cease its irritating attacks until the first frosts of winter. The name of the genus indicates the cause of this irritation, being derived from the Greek, and signifying sharp mouth; the proboscis being very acute and horny, so as to enable it to puncture not only the skin of man, but also the tougher coats of the ox and horse. After it has filled itself with its sanguinary repast, the

wound does not at once close, but continues to bleed for a time. The common species (*Stomoxys calcitrans*) is most abundant in autumn, hence the origin of the common error that at this period of the year the domestic fly is most tormenting. Some individuals of this species (probably impregnated females) hide themselves during the winter, becoming torpid, sometimes as many as a score may be found packed closely together in the stumps of old trees, especially in situations where a moisture has exuded which has probably served for their food, or upon which they will feed when they regain their activity. M. Desvoidy has united the *Stomoxydæ* with the *Muscidæ*, and has formed the *Stomoxys irritans* into the genus *Hæmatobia*.

CONOSPERMUM (R. Brown). New Holland ornamental ever-green shrubs, belonging to *Tetrandria monogynia*, and to the natural order *Proteaceæ*. Generic character: calyx tubular, gaping; upper segment hollow at the base; anthers three, side one halved, the upper two lobed; stigma free; nut inversely cone-shaped, crowned with rigid hairs. These plants have narrow heath or yew-like leaves, and therefore add variety to the green-house collection.

CONOVULUS (Lamarck; a *Volute* of Linnæus). One of its species has also been classed, by Lamarck, with the genus *Tornatella*; both of them are now, however, placed with the *Pedipes*, in the second family *Auriculaceæ*, first order *Pulmobranchiata*, second class *Paracephalophora*. The shell is thick, ovoid, sub-involved, the spire very short, the last whorl much larger than all the others united; the aperture long, oval, or linear, the edges not united, the external one sharp and thin, internally dentated; one or two decurrent plaits at the columella, one of which serves to separate the two portions of the animal's foot. The animal, according to Adanson, is known. Several fossil species are mentioned by De France, which are classed with the genus *Tornatella*.

CONULARIA. A fossil species of mollusc, of which the *Conularia Sowerbii* is an example; it is, however, a badly defined genus and should not be placed with the *Orthocerata* of the modern school, except as being greatly similar in structure to many of its species.

CONUS (cone)—(Linnæus and various modern authors). Shells of this extensive and elegant genus are generally so well known to every collector, that it were needless to say their name is derived from the resemblance to a cone. The genus comprises not only the most beautiful, but also the most numerous of the class which comprehends the spiral univalves. Among them are many of high price, even at the present day, when the rarity of certain species is less than it was a few years since, from the increased researches made in this branch of natural history, and from the competition in our sale-rooms becoming less in proportion. Cones constitute a very natural and easily distinguished association of molluscs, including an almost endless number of species and varieties; but few other shells can, by possibility, be confounded with them. To a casual observer, some others, however, present a striking resemblance; the cowry (*Cypræa*), in a young state, has been mistaken for a cone, though it is then very thin, and all cones are thick and heavy, and one author, of little repute it is true, has confounded a species of the genus *Oliva* with the cones. The most remarkable and distinguishing

character of this genus is, the shell having the whorls compressed and rolled over each other, the outer one being visible, and the upper edges of the previous evolutions only seen with a suture or groove between them. These spiral elevations form the spire, which is sometimes nearly flat, convex, more or less produced, and occasionally even slightly concave; the extremity of the whorls coronated, smooth, or tuberculated. It results from the form of the shell, and the spiral cavity (which contains the animal) being compressed in its whole length, and the larger part near the spire, that they may strictly be called turbinated shells attenuated towards the base; the aperture is narrow, effuse at the base, never dentated or the axis plaited, and the outer lip smooth and sharp; it does, however, sometimes present a slightly waved appearance in certain species, particularly at the anterior extremity, which may there be called plaited obliquely. Lamarck has divided this genus into two sections, the first including the coronated cones, the second, those with a plain spire; but this genus, like other very numerous ones possessing but few variations of character, requires a more natural association of its species, as a guide to which, the peculiar structure of the spiral whorls, in addition to the more or less elongated form of the shells, might safely be adopted by the naturalist.

Lamarck and all subsequent writers have omitted some particulars tending to exhibit, more strongly, the peculiar characters of this elegant shell; the aperture is terminated, at the upper part, in a notch, more or less distinct, admitting the protrusion of an organ of the animal, and occasioned also by the suture or separation of the external whorl from the spire; beneath this appears a slight callosity, running round the interior of the shell.

The form of the shell is extremely various, some being rather thin, cylindrical, and oval, others short and wide, some with a spire very much produced, while, in others, it is nearly flat and truncated, either mucronated, coronated, tuberculated, or with flattened or convex whorls; the exterior more or less covered with minute granulations; some are quite smooth, and others transversely grooved or sulcated; all the species may be presumed to have an epidermis, which, in some, is very thick and has a tufted appearance. Adanson, whose veracity has never been impugned, asserts, that these shells are closed by a very small horny operculum sub-spiral, with a terminal summit; but of some hundred specimens of cones which have passed through our hands, no one ever has been met with by us possessing an operculum. The animal constructing this shell is of a lengthened very compressed form, rolled round like a riband wound up on its own axis; the mantle is extremely thin, not projecting beyond a rather small foot, of a lengthened oval form, larger in front, where it is bordered by a transverse groove; the head is very distinct, the tentacula cylindrical, with the eyes situated near their summits, which are setaceous; the mouth is placed at the bottom of a rather long labial trunk, the tongue is rather short, although salient in the visceral cavity, and bristled with two rows of long styliform hooks.

The following distribution of species has been made by French naturalists, and it is tolerably natural, though admitting of some reformation. The first division consists of those cones which have the form of the body regularly conical, with a projecting spire, *not* coronated or tuberculated, as is the case

case with the *Conus generalis*; the second, such as have a spire salient or projecting, but with its whorls *coronated*, projecting, or flat, as in the *Conus imperialis*. In these examples we may point out the reasons why we differ with such an arrangement; taking as our guide the formation of the spire, it is obvious that the animal constructing the *C. generalis* has an organised portion of its body immediately under, and upon which the spire was formed, different from that which exists in a similar position in the *C. imperialis*, where the knobs or coronated processes are so distinctly defined, and can only arise from corresponding elevations of the animal's body; on this account, therefore, we would suggest the separation of all species having a distinction so clearly marked: it cannot, it is true, in any way change the classification of the inhabitants, since they remain precisely the same in all their organs, though those organs differ in form, length, and particularly in size, it is, therefore, from the modifications of these at the posterior part of the animal's body that the spire exhibits its various characters. The substance of the animal's body, that is, its being of an uniform thickness throughout its whole length, or its being in some parts thicker than in others, constitutes the difference that exists in the *external* form of the cone, by which it is rendered more or less perfectly conical, globose, elongated, or compressed, and the peculiar manner in which the animal's flat riband-like body is rolled up distinguishes the length of the spire. This may be easily understood by the familiar illustration of a narrow roll of paper, one end of which is more or less drawn out, so if we imagine that roll to possess at one end convex portions at stated intervals, these would form the coronated or tuberculated spire; and were the roll of paper more or less convex throughout the whole of its breadth, the loosely formed cone made from it, would be rendered globose in proportion to that convexity, whether in one part of its folds, or uniformly in every part. Many cones are also granulated on their exterior, some grooved, and others variously sculptured; these variations are easily understood, as corresponding with similarly formed portions of the animal's body. See CONCHOLOGY. They, we also think, should tend to point out the natural association and progressive links of the species. The third division made by the French naturalists is, that in which the species are but little elongated, more oval, the spire rather projecting, pointed, and *not* coronated, as in the *Conus textile*; the fourth, such species as have the spire apparently *coronated*, and the form of the body sub-cylindrical, as in the *C. geographus*; the fifth includes the species much elongated, cylindrical, a salient spire, the aperture resembling that of the genus *Terebellum*, that is, angular at its posterior portion—this is exemplified in *C. mitratus*, *C. nussatella*, and others.

In these sub-divisions it must again be pointed out that they are to be considered with reference only to the classification of the shells themselves, the animal itself always remaining one and the same species in all. It belongs to the second class *Paracephalophora*; first order *Siphonobranchiata*; third family *Angyostomata*.

Lamarck enumerates 181 recent species, more are, however, now described; they are the most abundantly found in tropical climates, and like many other molluscs become more rare as they approach the northern hemisphere, where none exist, and only

four, or perhaps five, species are to be found in the Mediterranean. Fossil remains of the genus are not uncommon, and are widely distributed, never being found in masses, as frequently occurs with other genera of molluscs.

These shells are unquestionably the most elegant of all the various known genera; their form is always graceful; they present, in their coloured portions, every possible shade, including that of green, so rarely found in other molluscs, and the diversity of marking in the different species baffles description or correct imitation.

Though it forms no part of this work, properly speaking, to point out present, or former rarities of the species of molluscs, we cannot, however, avoid trespassing upon the space allotted to our subject, by briefly pointing out some of those which, from their extreme beauty, will ever retain a marked preference. At the head of which must stand the well-named cone (*Conus cedonulli*), in all its varieties; the *C. aurisiacus*, and the varieties of the *Conus ammiralis* are, nevertheless, scarcely inferior in beauty. One species has long preserved a reputation it probably merits more from its great rarity than its extreme beauty—it is the *Conus gloria maris*, for though it is a most elegant mollusc, there are some varieties of the *Conus textile* which approximate it so closely, that we only consider it a variety of that species. We have named these cones as a few of the most rare and beautiful known, but amongst the most common numbers exist, which, if equally rare, would rival them in elegance of form, colouring, and pencilling.

In the records of conchological extravagance, it is stated that some examples of rare cones have been so strongly competed for by amateur collectors, that one hundred pounds have been given for them; it is, indeed, within our own knowledge, that twenty pounds have been paid for a fine specimen of the *cedonulli* and *aurisiacus* cones; and even at the present period they could not probably be bought under half that amount. The somewhat trite adage of a "fool and his money being soon parted," does not, however, in this instance, more particularly apply, than in a thousand others; from the earliest ages of history mankind have been often known to sacrifice, not only immense sums, but every moral duty towards their fellow creatures, to acquire possession of an object not attainable to others on the score of riches or vanity. To a certain extent, wealth must ever command an indulgence of this or any other bad passion; but, happily, the satisfaction of doing good so much preponderates, that instances of selfish extravagance are hourly becoming less conspicuous. The blind gifts of fortune are dispensed with a liberal, discriminating judgment, by those who enjoy a superfluity of them, and are blessed with minds so constituted, as to appreciate the sacred duties which rank or wealth impose upon them, by alleviating the sufferings of beings less fortunately placed in the scale of worldly enjoyment than themselves.

CONVALLARIA (Linnæus). The *C. majalis* is a British plant, and one of the most valued of the British flora, under the name of Lily of the Valley. Linnæan class and order, *Hexandria Monogynia*; and natural order *Smilacææ*. Generic character: corolla tubular, limb six-cleft; stamens joined to the tube; filaments awl-shaped; anthers erect, and somewhat egg or heart-shaped; style columnar; stigma headed. Berry of three cells, each containing several seeds.

The simple beauty of the smooth fresh green leaves, surrounding and serving as a background to the elegant racemes of pure white nodding flowers, is a contrast which enhances the value of both. Those who are the least sensible of the beauty of flowers, appear charmed with the simple elegance of the lily of the valley. So much has it been cultivated in every garden, that two varieties have been already obtained, namely, the red flowering and the double; all of which are easily increased by division, and will thrive in any shady place.

CONVOLVULACEÆ. The bindweed family. A natural order of dicotyledonous plants, containing upwards of twenty genera, and between two and three hundred known species. Its plaited corolla, and climbing habit, are the characters by which this order is best distinguished from all others. It bears an affinity to *Cordiaceæ* in its shrivelled cotyledons, and it is also allied to *Polemoniaceæ* and *Hydroleaceæ*.

Its essential characters are: calyx with five divisions, persistent; corolla monopetalous, hypogynous, regular, the limb five-cleft, generally plaited and deciduous; stamens five, inserted at the bottom of the corolla, and alternate with its segments; ovary single, two to four-celled, rarely one-celled, sometimes in two or four divisions, with few definite erect ovules; style one, often divided at the apex, sometimes as far as the base; stigmas obtuse or acute; capsule one to four-celled, the valves corresponding to the angles of a free dissepiment, bearing the seeds at its base, sometimes without valves, or opening transversely; seeds with a small quantity of mucilaginous albumen; embryo curved; cotyledons wrinkled; radicle inferior.

The plants belonging to this order are herbs or shrubs, which are usually climbing, milky, smooth, or with a simple pubescence. Their leaves are alternate undivided or lobed, without stipules, and their inflorescence terminal or axillary. They have frequently showy flowers, which expand beneath the influence of bright sunshine. They are found twining round other plants, or creeping among weeds on the sea-shore in the tropical regions of the globe, and are by no means abundant in cold climates. Their roots abound in an acrid milky resinous juice, possessing purgative qualities. Some of them are employed as articles of food.

The chief genera of the order are, *Convolvulus*, *Calystegia*, *Ipomœa*, *Cuscuta*, *Evolvulus*, *Argyrea*, *Falkia*, and *Retzia*.

Convolvulus, bindweed, is a very extensive genus, and includes some species which are prized on account of their beauty, or the valuable products which they furnish.

Convolvulus, or *Ipomœa jalapa*, is a climbing perennial plant, found near Xalappa, a town of Mexico. It was first brought to Europe in 1610. The root of the plant furnishes the medicinal *jalap*. It is a tuberous egg-shaped root, which, when fresh, is white and lactescent, but, as imported, is generally covered with a blackish wrinkled bark. It is sometimes brought to this country in the form of thin transverse slices, having a greyish colour internally. The tubers, when sound, are compact, hard, and heavy, and break with a resinous fracture. They have a nauseous taste and smell, and seldom exceed a few ounces in weight, with a diameter of two or three inches. When powdered, jalap has a yellowish grey colour.

The roots of common bryony, the marvel of Peru (*Mirabilis jalapa*), and of other species of *convolvulus*, are often mixed with those of the true jalap.

Jalap has been ascertained by analysis to consist of resin, extractive matter, starch, vegetable albumen, woody fibre, and various salts. A substance has lately been obtained from jalap possessing powerful purgative properties, and which, from being considered its active principle, has been denominated *Jalapine*. The observations made in regard to it however, are not as yet satisfactory.

The properties of jalap reside chiefly in the resin. When administered in small doses, of ten or fifteen grains, this medicine is an effectual, safe, and mild purgative; but when given in large doses it produces griping, watery evacuations, and may even excite inflammatory action. Camphor is one of the best substances for preventing its griping effects. It is frequently prescribed in combination with calomel and cream of tartar. When mixed with two parts of the latter salt, it constitutes the compound jalap powder of the Edinburgh Pharmacopœia.

The watery extract of jalap possesses the properties of the root in a weak degree. The resin, by itself, produces distressing symptoms, without much effect in evacuating the bowels. Diluted alcohol, or proof spirit, dissolves almost all the active ingredients of jalap.

The root of *Convolvulus panduratus* is used in the United States as a substitute for jalap.

Convolvulus scammonia (scammony), is another climbing species of bindweed, found in the Levant, Syria, and Turkey, and growing abundantly on the mountains between Aleppo and Latakia. The roots of this plant are three or four feet long, and nine or twelve inches in circumference, and when cut yield a milky juice, which concretes, and forms the gum-resin known in medicine by the name of scammony. The following is the mode in which the gum-resin is collected:—The earth being removed from the upper part of the root about the month of June, an incision is made obliquely across it, and the milky juice which exudes is allowed to flow into a shell or cup placed at the lower end of the cut. After the vessel has been left for twelve hours, it is removed, and the concrete juice is taken out. Each root yields only a few drachms. The produce of several roots is then collected, and put into packages or drums, as they are called, which weigh from 75 to 125 pounds. The best scammony is brought from Aleppo. An inferior sort is exported from Smyrna in the form of cakes, like wax, packed in chests. This would appear to be the produce of another plant, *Periploca scammonium*.

Scammony is frequently adulterated with sand, ashes, and the juice of other plants, such as *cynanchum*, *monspeliacum*, &c. The Smyrna scammony is said to be sometimes an entirely artificial compound, containing no real scammony whatever.

Pure Aleppo scammony occurs in the form of light, spongy, friable masses, having a heavy disagreeable smell, a bitter acrid taste, and a blackish or dark grey colour. When broken, it exhibits a smooth somewhat shining fracture, and when powdered is of a light grey, or whitish colour. Scammony consists of resin, gum, and extractive matter. It possesses powerful purgative qualities, which reside in the resin, of which it is chiefly composed. It is administered in doses of five or ten grains, and is frequently prescribed in combination with calomel,

jalap, cream of tartar, and sulphate of potass. It is sometimes triturated with sugar or almonds, and is then said to be mild in its operation. It is often used in cases of dropsy and worms.

Both scammony and jalap, when rubbed externally on the skin, produce purgative effects.

Convolvulus arvensis, small bindweed, is common in corn-fields and by the sides of hedges in Britain. Its flowers are small and rose-coloured, and it has a white-jointed root, which runs deep into the ground, and is difficult of extirpation. It twines round wheat and other kinds of grain, and is a troublesome weed in cultivated grounds. Its presence is said to indicate in general a dry soil. Its juice is slightly purgative, and its blossoms give to water a deep yellow colour, which is increased by the addition of alum and alkaline substances.

Convolvulus, or *Calystegia sepium*, great bindweed, is another indigenous species, which is much larger than the preceding, and produces showy white flowers. The inspissated juice, in doses of twenty or thirty grains, is said to be purgative.

Convolvulus, or *Calystegia Soldanella*, sea-side bindweed, is the only other British species. It is common on sandy places by the sea-shore. Its root is long and creeping, and its flowers few, large, and rose-coloured.

Convolvulus batatas, skirrets of Peru, Spanish potatoes, or the common sweet potato of Europe, is a native of the East and West Indies and of China. It was first brought to Spain from the West Indies, and its root used to be imported into this country as an article of food. Its root is the potato of Shakspeare, and the writers of his day, at which time our present potato (*Solanum tuberosum*) was scarcely known in Europe. In tropical countries it is still cultivated like the potato. Not only its tubers, but also its young leaves and shoots, are boiled and eaten. The root of *Convolvulus edulis* is also frequently used as food.

The roots of *Convolvulus floridus* and *scoparius* produce sneezing. The wood of the latter species, which grows in the Canary Islands, is remarkable for its fine rose-like odour. *Convolvulus repens* is employed as a pot-herb in the East Indies and China. *Convolvulus turpethum* (*turbith* or *turpeth*), is a native of the East Indies, and furnishes a root which has been used medicinally as a cathartic. A resinous matter is obtained from it. *Convolvulus Malabaricus*, a native of the Malabar coast and Cochin-China, is considered in India a valuable horse-medicine. The genus *Ipomœa* consists of twining stove plants, which are easily cultivated, and flower very readily. Upwards of one hundred species are described by botanists. They are remarkable for the beauty of their flowers, which, though they are individually short-lived, yet they are succeeded so rapidly by others, that there are few more showy ornaments of the forests in warm countries, or of stoves in our own. *Ipomœa tuberosa* is a plant of great beauty and fragrance. In Jamaica it is evergreen. It is thickly covered with leaves and large flowers, and is a beautiful ornament of arbours. It yields a milky juice, which, when concrete, resembles scammony. *Ipomœa inamœhit* is a beautiful annual. Its root is used as a sternutatory.

Cuscuta—dodder, a genus of leafless plants, which, after germinating in the ground and deriving nourishment from it, become parasitical, and attach them-

selves to some plants in the neighbourhood. Their stalks twine round these plants, contrary to the sun's apparent motion, or from right to left, sending out from their inner sides little papillæ or tubercles, which attach themselves to the bark of the supporting plant, and finally become firmly and intimately united with it. They then derive their support and nourishment from the plant to which they become attached.

Cuscuta Europæa, great dodder, is found in Britain on nettles, flax, &c., and produces flowers of a pale yellowish rose-colour. *Cuscuta epithymum*, lesser dodder, another British species, is found on furze, heath, and thyme. It is distinguished from the preceding species by having a scale at the base of each stamen.

CONVOLVULUS (Linnæus), is the very significant generic name of all that family of plants called bindweed. They belong to the fifth class and first order of Linnæus, and, as we have already stated in the previous article, give a title to an order in the natural system. This genus is spread over every part of the known world, and appears in every degree of bulk and beauty, and of every grade as to duration; some are annuals which embellish our flower borders for a few months, and then disappear; some are biennials, but the great majority are perennials. They are nearly all either creepers, twiners, or climbers; many are troublesome weeds, though the flowers of all are showy. They are all easy of cultivation, and thrive in almost any kind of soil. This genus, though still very numerous, was formerly much more so, many of the species having been separated, and added to the two congeneric genera of *Ipomœa* and *Calystegia*.

CONYZA (Linnæus). A genus of shrubs and herbaceous plants found in many and distant parts of the world, and known by the common name of fleabane. Linnæan class and order *Syngenesia superflua*, and natural order *Compositæ*. Generic character: anthodium scaly; receptacle naked; florets of the ray trifid, or somewhat two-lipped. The fleabane is a British biennial of no great beauty; the foreign are mostly of like character. Some of the shrubby species are kept in greenhouses, where they are easily increased by cuttings treated in the usual way.

COOKIA (Sonnerat). A genus of fruit tree indigenous to China and the neighbouring countries, and called by the natives wampee. Linnæan class and order *Decandria monogynia*, and natural order *Aurantiacæ*. Generic characters: calyx in five parts; petals five, white, and villous; stamens filaments linear; anthers roundish, apple imperfectly two-celled, one seed in each. The tree has been long in our collections, and grows well in a large pot, in loamy soil. From what we have experienced of other Chinese plants, such as the tea-plant, camellia, and others, it may be expected that the wampee may bear our winters if planted against a south wall, and be allowed sufficient protection against frost.

COOT. See FULICA.

COPPER. The mineralised ores of this metal are very numerous, and it is found in a native state in many parts of the world. Native copper occurs in a variety of forms, massive, dendritic, granular, and crystallised in cubes, octohedra, &c. This mineral is accompanied by several other substances, as the ores of zinc, and occasionally of lead; sometimes of tin, silver, and arsenic, with quartz and fluat of lime, and calcareous spar in abundance. It is met with in Cornwall, the Hartz, Saxony, Sweden, and

in America, but the native coppers of Japan and Brazil are usually alloyed by gold. It is commonly accompanied by quartz, heavy spar, and calcareous spar, except in Cornwall. Mineralised by a certain proportion of oxygen, it forms a beautiful mineral, called the red oxide of copper, which assumes a great variety of forms, all of which may be traced into the regular octahedra; but with an increased proportion of oxygen, it assumes a black hue, and is mostly pulverulent.

The foliated and compact red copper ore occurs in different veins in the mine of Huel Gorland, in Cornwall. All the veins traverse granite, and three of them, viz. the North Lode, the Great Gossan Lode, and the Muttrel Lode, afford the red copper ore. In the North Lode it is associated with fluor spar. In the Great Gossan Lode it occurs in considerable quantity, and is occasionally intermixed with native copper; higher up in the same vein there is abundance of fluor spar, sometimes intermixed with arsenical pyrites, and copper pyrites. In the Muttrel Lode the copper ore is occasionally accompanied with copper glance, or vitreous copper ore, black oxide of copper, olivenite, arsenical pyrites, quartz, and fluor spar. It is also found in several other mines. Small portions of this ore occurs, along with native copper, in the trap-rocks of Nalsole, one of the Faroe Islands; also in the mine of Aardal in Norway, and Garpa in East Gothland, in Sweden. It occurs but sparingly, and along with native copper, in the Kimmelsberg, in the Hartz; near Freyberg, along with native copper, ochry-brown iron ore, lamellar, heavy spar, and quartz. In Asia this ore of copper occurs in the Uralian chain of mountains, and also in the mines of Kolywan. In America it is principally found in Chili and Peru. Both the blue and green carbonate of copper are found in a native state, the latter under the name of MALACHITE, which see.

COPRIS (Geoffroy). A very extensive genus of coleopterous insects belong to the section *Pentamera*, and sub-section *Lamellicornes*, and family *Scarabidæ*, having the body large and thick; the antennæ terminated by a three-jointed fan-like club; the head and thorax often armed with powerful horns, especially in the males; the scutellum appears entirely wanting, and the four posterior tibiæ are strongly dilated and obliquely truncate at the extremity. The Count De Jean enumerates eighty-four species of this genus, which are for the most part inhabitants of the warmer quarters of the globe, especially frequenting Africa and the East Indies, where they are important agents in the economy of nature, the eggs being buried in the excrement of various animals, within which the larvæ feed and the beetles are perfected. The species which we have figured in our plate of beetles, from the collection of the Rev. F. W. Hope, is the *Copris isidis* of Savigny, one of the largest insects in the genus, of a black colour (as indeed are all the species), with reddish hairs in front of the thorax; it is from Egypt. There is only one British species, the *Scarabæus lunaris* of Linnæus (the *Scarabæus emarginatus* of Fabricius being merely the female). It is of a black colour, with the single upright horn in the middle of the head in the male. It is nearly an inch long, and may be occasionally found emerging from holes made in the ground beneath cow-dung, and taking flight towards sunset.

CORALLIFERA, a numerous order of marine animals belonging to the class POLYPT, which see.

CORDIACEÆ. A natural order of dicotyledonous plants, containing six or eight genera, and upwards of fifty species. It is closely allied to *Boraginææ*, and by many authors is looked upon as a section of that order. It is distinguished, however, by its general habit, its plaited cotyledons and dichotomous style. It bears an affinity also to *Convolvulaceæ*, from which it differs in its inverted embryo and drupaceous fruit.

The essential characters of the order are: calyx inferior, five-toothed; corolla monopetalous, with the limb in five divisions; stamens alternate with the segments of the corolla, out of which they arise; ovary superior, four-celled, with a pendulous ovule in each cell; fruit a four-celled drupe; embryo inverted; cotyledons plaited or shrivelled longitudinally; seeds without albumen.

The plants belonging to the order are trees with panicled, bracteate flowers, and alternate rough leaves without stipules. They are found in tropical regions in both hemispheres.

They generally yield emollient and mucilaginous fruit, but little is known in regard to their properties.

The chief genera of the order are: *Cordia*, *Varronia*, *Geraschanthus*, *Cerdana*, *Cordiopsis*, and *Menais*.

Cordia myxa is a large tree, growing in the East Indies, and yielding a yellow-coloured fruit the size of a cherry, which is eaten by the natives. The bark of the tree is tonic, and is used in Java in cases of fever. Its wood is tough and solid, and is employed to procure fire by friction. The leaves are bruised with those of *Datura metel*, and applied to the forehead in headach. A kind of glue is prepared from the fruit.

Cordia sebestena is a very ornamental tree, on account of its large tubular scarlet flowers. Its wood is odoriferous when burnt; a small bit of it put on a pan of heated coals will perfume a whole house. From the juice of the leaves, with that of a species of fig, the inhabitants of Otaheite procure a fine red colour, with which they dye their clothes. The fruit of this and the last-mentioned species are commonly known by the name of sebesten plums. These are occasionally brought to Europe in a dried state, and their pulp is said to act as a laxative.

Cordia collococca is called in India clammy cherry or Turkey berry tree. Its leaves are used in that country to feed poultry.

CORIARIEÆ. A natural order of dicotyledonous plants, containing only one known genus and seven species. It is allied to *Ochnaceæ*, but differs in having no style, and in its stigmata being long, linear and distinct. It also resembles *Rutaceæ*, the rue family, and has some affinity with *Connaraceæ*. The essential characters of the order are: flowers either hermaphrodite, monœcious or diœcious; calyx five partite; petals five, fleshy, with an elevated keel in the inside; stamens ten, of which five arise between the lobes of the calyx and angles of the ovary, and other five between the petals and the furrows of the ovary; filaments thread like; anthers oblong, two-celled; ovary on a fleshy disc, five-angled and five-celled; no style; five long awl-shaped stigmas; five carpels which are one-seeded, and close together when ripe; seed pendulous, without albumen; embryo straight; radicle superior; cotyledons fleshy.

The plants belonging to this order are: shrubs with opposite square branches, opposite entire leaves, scaly buds, and terminal racemes, which are leafy at the base. They are found in various parts of the

world ; in the south of Europe, in Peru, New Zealand, and Mexico.

Coriaria is the only genus of the order.

Coriaria myrtifolia grows in hedges, and thickest in the southern parts of Europe and in the north of Africa. Its leaves and young branches are astringent, and are used in dyeing black and in tanning. The plant yields a poisonous fruit, which has proved fatal on some occasions. Several soldiers of the French army, in Catalonia, were stupefied by eating it, and some died from its effects.

Its leaves are said to be sometimes mixed with those of senna. According to M. Guibourt, this adulteration is detected by the infusion with hot water, having a pale yellow colour and astringent taste, by a white precipitate being thrown down by gelatin, a blue by sulphate of iron, a black by nitrate of silver and nitro-muriate of gold, and a gelatinous compound by caustic potass.

CORMORANT (*Phalacrocorax*), a genus of sea-birds belonging to the family of *Totipalmæ*, or those which have the hind toe included in the web of the foot, as well as the three front ones. The structure and action of a foot of this kind will be found noticed in the article BIRD ; so that we need not repeat it here. In their general characters, this genus is nearly allied to the pelicans, and were included in the same genus by Linnæus and his followers ; but Cuvier has very properly separated them, as they are so different both in structure and in their general economy, that the same description will not apply to them, and when that is the case there ought always to be a separation of genera.

Cormorants are sometimes called sea ravens, or sea crows, and they have nearly the same voracity as the land ravens, though their prey and manner of catching it are both very different. Cormorants generally fish near the shores, and are more frequently on the wing over the water than at rest upon the rocks. When they pursue their prey in the sea, they do not hesitate in coming near inhabited places ; but when they fish in the fresh waters they choose more lonely haunts. They catch their prey, which consists wholly or chiefly of fish, by the middle with the bill ; and as they cannot easily swallow it from this position, or indeed if it is presented to the gullet in any other way than head foremost, they throw it into the air and seize it with great dexterity as it falls. All birds which fish along the surface of the water, and indeed all animals which swallow their prey without masticating or dividing it with the teeth, are dexterous at this mode of turning a fish.

This is one of the most remarkable instances of adaptation with which we meet in nature, and ought to teach us to look for the intelligence of the creature somewhere else than in the creature itself, is the fact that the action performed in this perfect manner by the organised animal is not the result of the organisation, neither is the organisation the result of the action. A cormorant does not catch fish by dashing into the water, and following them to a greater or less depth, as may be necessary, *because* its feet, its wings, its bill, and all the other parts of its organisation are fitted for such purposes, any more than it throws the fish up into the air, because it has a knowledge that the fish will come down in a more manageable posture for swallowing than that in which it is seized by the bill. As little can we say that the bill has or can have any controul

over what its organisation shall be, for the organisation precedes the action in the order of nature. The instinct follows the race, and is true to it ; which we find is not the case either in knowledge or in action with us. Therefore, when we examine the more curious functions which are performed by the lower animals (as we term them), we meet with far more striking evidences of Almighty wisdom and power than we do in the case of human conduct. There are no productions which assist us more in the forming of these general views than those birds which seek their food in the waters ; and as the cormorants find their food by skill and energy, not by craft, there are few sea birds better worthy our attention.



Cormorant.

The characters of the genus are as follows :—The bill long, or of mean length, compressed, rounded in the culmen, straight for the greater part of its length, but much hooked at the tip of the upper mandible, and having the extremity of the lower one truncated, so as to act against the hook. The base of the bill has a small cere, and the naked skin is continued on the throat, and partially also on the face. The nostrils are at the brow of the bill, in the form of longitudinal slits, and barely visible. The legs are stout, the tarsi short, and rather inclined toward each other. The hind toes are turned inward, and included in the web of the feet ; the outer toe is the longest and strongest in the foot ; the claws are not large for the size of the foot, and that on the middle toe is toothed on the edge. The wings are of rather more than mean length, and they are rather pointed, the second quill being the longest. They are not, however, formed for whirling and turning rapidly in the air ; and the rounded extremity of the tail further shows, that whirling in the air is not one of the principal actions of the bird. There are several species :—

P. carbo, the common cormorant, or great cormorant. This species is common on the British shores, and in some places it moves inland to the lakes which are near the sea, or to the larger rivers, which have long tideways. In these last situations, it is often

found standing or nestling on trees; but as a sea-bird, its place of repose and nestling is the rocks.

This is a large bird: three feet in length, nearly five feet in the extent of the wings, and weighing as much as seven pounds; but this must be considered as the dimensions of a large specimen, and the sizes are apt to vary. Length of the bill about five inches, and of a dusky colour for the greater part of its length, but with the cere yellow; tarsi, toes, and webs sooty black; irides bright green. The plumage varies a little with the season. General colour, greenish black, with black margins to the feathers on the back, and a line of ash colour on the scapulars. In the breeding season, the neck and thighs are mottled with small white feathers, and there is a crest of long green feathers on the back of the head. In winter these feathers fall off, and the general tint of the upper part becomes rusty. There is also a white gorget on the neck, which becomes much duller in the colour during winter.

Though these birds are generally found in remote and inaccessible places for their nests, such as high trees and detached rocks, they are social with each other, and many nests are often found in the near vicinity of each other. The eggs are three or four in number, of about two ounces in weight, greenish white, and with the surface of the shell rather rough.

Though cormorants are industrious and successful fishers, and as such thin the waters of their finny inhabitants to a considerable extent, yet they pursue their fishing with peace and good order, and never interfere with or annoy any other birds. It can be tamed very readily; and a detailed account of one in a domesticated state may be found in Montagu's Ornithological Dictionary.

The common cormorant extends to the very coldest parts of the northern hemisphere, being found in Greenland. Wherever, indeed, there is an open sea, and high rocks to afford the resting place which the birds most affect, there is never any want of cormorants, though in such places they are forced to shift their quarters with the season. They are driven not merely by being frozen out, but by the unusual departure from the coast of those fish on which they feed; so that, if the movements of cormorants and other fishing birds were properly attended to, it would throw very considerable light, not only on the natural history of the inhabitants of the waters, but on the seasons at which fishing for the different kinds of the finny race can be carried on with the greatest success, and where every species should be sought for, when it disappears from any particular spot. All oviparous fishes, and they comprise the kinds which are most valuable to man as food, spawn on the banks or shores, or in the estuaries of rivers; and the young remain for a considerable time near the shore before they betake themselves to the deep water. Much of the spawn is detached and brought to the surface, or washed to the water line on the shore, where it forms a very considerable part of the food of terns and other skimming birds, and also of those birds which pick up their food, by running along the sands. Therefore, we find these birds on the shore, and in the full activity of breeding and nest building where the spawn is deposited. Cormorants and other fishing birds come later, after the fry have attained a considerable size, and their breeding time comes on when the numbers and size of the young fish on the coast are a maximum as taken together. When the spawn is gone,

and the young fishes have attained considerable size, the skimming birds which, by this time, have reared their broods, find it necessary to disperse themselves over the ocean. The fishing birds, properly so called, have then the shores in a great measure to themselves, and, as the weather suits, they may be seen driving about with great activity. But their time for dispersing comes in the end, and they scatter more widely along the shores than the skimmers, as they are larger birds, and individually consume more food; and it is on such occasions as this that the cormorants, which are perhaps the most voracious of the whole, betake themselves to the fresh waters, though, where these waters are large, and abound with fish, cormorants sometimes choose their breeding places on the trees near such waters, in the manner that has been described already. When they nestle on the rocks, or even when on trees, they do not, as is the case with many other birds, return to the same rocks, but shift about from one to another.

When they are not employed in fishing, and especially when they have fished to the full expansion of their wide and swelling stomachs, they sit down in a state of very dismal repose, and at other times they may be seen by dozens together, drying themselves on the rocks, with their wings spread out as flat and as motionless as if they were dead carcasses which had been placed there by human art.

As food, the cormorant, though a large bird, is of little or no value; the smell of it is very rank and offensive, and the flesh, dressed in any of the common ways, would suffice to turn the stomach of a Greenlander or an Esquimaux. But, in some of the northern islands, the young are eaten, and even relished as a sort of dainty, after having been buried for twenty-four hours in the earth, which is said to remove the bad flavour of the flesh, and also to make it tender. Soup made of them in this manner is said to taste *something* like hare-soup; but we should be a little sceptical of the fact, though good soup may be made with *any* thing in it as *one* ingredient, which is not of so positively offensive a nature as to spoil the rest.

When regal amusements consisted more of field sports than they do in these days, there was an office of the royal household of England, known by the style and title of "Master of the King's *Cormorants*." Whether such an office may not still exist, and be exercised under another name, is not a point which writers on natural history are called upon to settle; but it is certain that, in those comparatively rude and primitive times, cormorants were trained to catch fish, and prevented from swallowing what they did catch by a tight collar of leather put round the neck. They were not difficult to train, were expert in their labour, and docile and easily managed.

P. graculus (the Shag, smaller cormorant, or smaller sea-crow). This species is much smaller than the former, and it is also more lightly made, and more active, found at more places of the coast, and more constantly there. The action of the shag upon the water, on a fine breezy day, when the smaller fishes are near the surface, is very amusing, and even graceful. It floats with wonderful buoyancy in the air, twitches down to the water with the rapidity of lightning, and sometimes passes clean through the unbroken surge, and appears upon the wing on the other side.

The shag is subject to considerable varieties in size; and, as the young are without the crest, and

the old ones lose it in winter, we generally find the shag and the crested shag described in the books as different species. There is, however, every probability that they are the same.

Besides size and colour, the most remarkable difference between the shag and the cormorant consists in the number of feathers in the tail, which are only twelve in the shag, and fourteen in the cormorant. The tail of the shag is also larger, more wedge-shaped in the general outline of the end; it is also more graduated (*étagée*), that is, the ends of the feathers appear like a succession of steps, as they do in the tail of the magpie. The size, as we have said, varies, but the longest of them that have been measured is about two feet six inches in length, three feet eight inches in extent of wing, and weighs nearly four pounds. The shag is very abundant in the regions of the arctic circles, and is a bird of passage in the eastern countries of Europe. It has much the appearance and manners of the preceding, although the two species are not observed to consort. But they are alike greedy and voracious, and after having overgorged themselves, they are often found on shore in a drowsy and torpid state; but when the torpor is over, they appear again on the water, where they are extremely alert, and not easily shot, as they dive the moment that they perceive the flash of a gun, and take care afterwards to keep out of its reach. In swimming they carry their head very erect, while the body seems nearly submerged. From the circumstance of their feathers being not quite impervious to water, they do not remain on that element very long at a time, but are frequently seen flying about, or sitting on the shore, flapping the moisture from their wings, or keeping them for some time expanded, to dry in the sun and the wind. They nestle in the clefts of rocks, or in trees, the female laying two or three whitish eggs, much elongated, and of nearly equal dimensions at both ends.

P. Sinensis (the Chinese Cormorant). The tail of this species consists of twelve feathers, like that of the shag, and it is described as being intermediate between that bird and the common cormorant. It is blackish brown on the upper part, whitish, and spotted with brown, beneath, and the throat white. The irides are blue, the bill yellow, and the feet blackish. This is the Leut-ze of the Chinese, who instruct it in the art of supplying its owner with fish. On a large lake, Sir George Staunton and his party saw thousands of small boats and rafts, on each of which were ten or a dozen of these birds, which, at a signal from the owner, plunged into the water, and returned with fish of a large size. They appeared to be so well trained, that it did not require either ring or cord about their throats to prevent them from swallowing any portion of their prey, except what the master was pleased to return to them for encouragement and food.

There are many species or varieties of cormorants in different parts of the world, especially in the south, but their habits are everywhere nearly the same.

CORNEÆ—The cornel family. A natural order of dicotyledonous plants, containing five genera and twenty-six known species. It is closely allied to *Caprifoliaceæ*, and is by many botanists considered as belonging to one of the sections of that order. It differs, however, in its valvate æstivation, the number of its stamens, its single style, its drupaceous fruit, and its fleshy albumen. By the same characters it is dis-

tinguished from the order *Hamamelideæ*, to which also it bears an affinity.

Its essential characters are: tube of the calyx adnate with the ovary, limb four-lobed; petals four, oblong, broad at the base, inserted on the top of the tube of the calyx, regular, with a valvate æstivation; stamens four, inserted along with the petals, and alternate with them; anthers ovato-oblong, two-celled; style filiform; stigma simple; drupe baccate, crowned with the limb of the calyx; seed pendulous and solitary; albumen fleshy.

The plants belonging to the order are: trees or shrubs, rarely herbs, with opposite, entire or toothed leaves, and capitate, umbellate, or corymbose flowers. They are found both in the cold and warm regions of Europe, Asia, and America.

The genera of the order are: *Cornus*, *Aucuba*, &c.

Cornus sanguinea, wild cornel tree, dogwood, grows commonly in Europe and in the northern parts of Asia. It is likewise found native in Britain. It bears greenish white flowers having an unpleasant smell. Its berries are of a dark purple colour, and like every other part of the plant are very bitter. An oil has been obtained from them which has been used for lamps. The bark of the older branches is dark-red, and the leaves assume this colour before they fall. The wood is hard, and makes good mill-cogs, bobbins for lace, tooth-picks, &c. It also furnishes excellent charcoal which is used in the preparation of gunpowder.

Cornus florida, American or Virginian dogwood, generally attains the height of twenty feet, with a diameter of four or five inches. The flowers are small, of a yellowish colour, and are surrounded by a large involucre, composed of four white floral leaves. This involucre constitutes all the beauty of the flowers. The wood of the tree is hard, compact and heavy, and is susceptible of a fine polish. It is used by carpenters. The inner bark of this and another species, *Cornus sericea*, is bitter, and is often used in North America as a tonic. In the United States, these barks are frequently prescribed for the cure of intermittent fevers. The young branches of the former species, when stripped of their bark, and rubbed with their ends against the teeth, render them extremely white. A good scarlet colour is obtained from the bark of the more fibrous roots.

Cornus Succica, dwarf-cornel, is found in Europe, the northern regions of Asia, Kamtschatka, Greenland, Lapland, and North America. It is also met with abundantly in mountainous pastures in Scotland and the North of England. It is a herbaceous plant, from four to six inches high, bearing an umbel of dark purple flowers. Its fruit has a red colour and a sweetish taste, and is used in the Highlands to create an appetite. The other genera of this order do not require to be particularly noticed.

CORVUS (Crow, or perhaps, in the more extended sense, *Corvidæ*, the crow family), a very numerous, widely extended, and well-known tribe of birds, belonging to Cuvier's coriostrial division of *Passeres*, and in the natural classification, or that which is founded upon the general habit in feeding, and not the mere structure of the feeding apparatus, to the order of *Omnivora*, or birds which are indiscriminate in their food, subsisting upon animal or vegetable matter, recent or putrid, according to circumstances, and thus being fitted for inhabiting almost every latitude on the face of the earth.

The general characters are : the bill short, more or less compressed or flattened on the sides, sharp and trenchant in the cutting edges, slightly curved towards the point, stout in its whole structure, and, though not a tearing instrument, like the beaks of birds of prey, generally very efficient both as a thrusting and a cutting one ; the nostrils are at the base of the bill, of an oval form, open, and defended by bristly hairs or stiff feathers, which project a little way forward over the base of the bill ; the feet have four toes, three directed to the front, the middle one shorter than the tarsus, the whole three divided to their bases, and one toe behind. The tarsi and toes are in general stout, and in some of the species they are provided with powerful claws, which are crooked, and serve for seizing and wounding their prey. The wings are in general long and pointed ; the second and third quills are, however, shorter than the fourth one, so that the wings are not of that form which is best adapted for turning readily in the air, and preying on the wing in that element.

Cuvier, following the general organisation, both external and internal, was induced to include in the crow family three races of birds, the crows properly so called, the birds of paradise, and the rollers. Some account of the second of these will be found in the article BIRD OF PARADISE, and we shall give some notice of the last in the article ROLLER ; so that the present article will be restricted to the crows properly so called, though strict systematists divide them into several genera, more certainly than are required for popular services, and probably more than strict science would warrant.

There is no question that Cuvier's union of the three races which have been mentioned into one group is warranted by the general organisation ; and it is equally true, that those who form arrangements upon external differences, without any regard whether these differences go farther than the mere surface or not, may make many subdivisions of a race so numerous, so widely distributed, and subjected to so many differences of food and climate as the crows unquestionably are. But, if we are to view the productions of nature in a popular sense, that is, in that sense in which they are calculated, with the least labour on our part, to throw light upon the natural usefulness of each other, we must adopt something like a middle course, so as neither to group too largely, nor to subdivide too minutely. Now, when we look at the three great divisions of which Cuvier forms the group, we find that each of them has, as it were, a different place in nature, is regulated by, or under, the controul of circumstances different from those which regulate the others, although we cannot always say distinctly what those circumstances are, or how they operate.

We find, however, that the birds of paradise are confined to a very peculiar situation on the globe, namely, the isles to the south-east of Asia, which have their climate, their seasons, and the greater part of their natural productions, peculiar to themselves, and not to be met with in any other part of the world. The rollers are not so confined or peculiar in their geographical distribution, but still they are found only in temperate latitudes, and in places which are well wooded and rich. Neither of them is, therefore, a race of birds which we can take along with us in our general tour of the world, or rather, which we do not need to take along with us, as in one or another

of their species we find them in every clime which we can visit. They are in the extreme north, in the middle latitudes, and also in the extreme south, and they are thus generally distributed always in proportion as they are more decidedly typical of the order. It is possible for a European to go where he can claim acquaintance with hardly one vegetable production, with few mammalia, few birds, and few fishes, and even where his own species seems, in appearance, in language, and in manners, more strange to him than any other inhabitant of the earth, even where the greater part are comparatively new. But a crow, and especially a raven, is instantly recognised as an acquaintance wherever it is met with, so that its appearance puts man in mind of his home, even though it is at the Antipodes ; and, if there were no other charm about the birds than this universal memory which they afford, it would be sufficient to recommend them to our grateful notice and our careful study.

Generally speaking, the genus *Corvus* are all sober, and even sombre in their attire, but there are a few exceptions ; and even in the most dull garbed ones there is a beautiful compactness in the plumage. Their feathers appear to be better tempered to the elements than those of almost any birds, and thus they are enabled to keep very constantly stirring and beating about on the wing ; so that, though many of them are remarkably social in their habits, firmly attached to the same places, and returners to their habitual dwellings every night, yet, taking them altogether, they range more in search of their food than almost any other birds ; and, as they are more generally distributed over the globe than most birds, so they are more spread over individual countries, notwithstanding that there is a certain kind of locality which each species appears to prefer to every other.

It is not a very easy matter to judge of the relative degrees of what we call sagacity or wisdom in birds, neither is it very easy to speak upon the subject without some chance of falling into error, because the inexperienced animal is just about as wise as the experienced one, and thus their wisdom, or whatever else we may call it, has a different origin, and is of a different nature, from that which is accounted wisdom in us. But still we cannot help comparing the degrees of this animal's sagacity as they display themselves in different animals ; and it is not the less valuable to make these comparisons, that we do not know the nature and origin of that which we thus compare. The fact is, that this comparison of one degree with another, without any primary standard, is far more general than its opposite. When we say degrees of heat, of light, of moisture, of growth, or even of magnitude, we do not speak in terms of an absolute standard—we merely mention observed differences ; and if we do this in the case of mere physical existence and its attributes, we cannot reasonably hope to be better informed, and more at home, when not merely life, but the degree of sagacity connected with life, is the subject of inquiry. Estimating them in this way, we may say, with no small degree of confidence, that the crow tribe are the most intelligent of birds ; and when we consider that they are, in one or other of their species, east upon the world generally for their means of support, instead of being confined to those places where a peculiar food for them is produced, we

might expect them to be possessed of this kind of sagacity.

Great acuteness of senses, and what, as compared with birds which are made for one place only, we may consider as remarkable habits of attention and observation, are necessary for this purpose; and accordingly, we find that these are possessed to an extent of which we have very few instances in birds, and of which it is not very easy for us sometimes to discover the use. There is certainly a perception of brilliancy of colour in these birds, and they make an election between substance and substance upon this principle alone, for which it is difficult to account upon any notion that we have of the supplying of their animal wants. Thus, for instance, if there are two little pieces of potter's ware, of the same size, shape, and consistency, and if the one side of them, as is often the case in coarse brown ware, be white and glazed, and the other not, if they are left in a magpie's way, one with the glazed side upward, and the other with the unglazed, the chance is, that the magpie will carry off the glazed and shining one, but certainly not the other; so also, if a shilling and a halfpenny are left in the way of the same bird, the shilling will likely be carried off, and the halfpenny left. If we were to argue this last election upon the principle of experience, or cause and effect, as those principles regulate our conduct, we should be apt to conclude that the magpie is not only fond of money, but a judge of the value of it. This cannot, however, be the case, inasmuch as, in times of her greatest famine, the magpie never thinks of fetching from her store of cash, or other valuables, wherewithal to purchase food, but beats the bushes with the same assiduity as if her coffers were empty.

The fact is, that these birds have a very strong habit of what we must call not merely observation, but curiosity in observation—a means, though it is impossible for us to say in what it consists of, judging of the appearance of things, and selecting one in preference to another on account of appearance only, and without any reference to intermediate usefulness in the supplying of any present want. Wild or tame, we find that animals of this family are always prying about, and that they not only perceive what is immediately beside them, but have no inconsiderable degree of knowledge of what is going on in the world around them; and though this vigilance renders them very wary of real danger, and very expert in the avoiding of it, it gives them a degree of self-possession much greater than that of most birds, and this seems to be one of the principal grounds upon which the whole race are so much more easily tamed, than from their cautious and wary dispositions we might be led to expect. In the case of most birds we require arts of taming, and in many the birds cannot be kept without the confinement of cages; but in the case of almost any species of this genus, we have only to feed them well, and they not only feel at home, but tender us their services in doing what they can to drive off other intruders.

Another remarkable quality of this, and some of the allied genera, is the great readiness with which they can be made to articulate, that is, to imitate the sounds of the human voice. This is so well known, that many people keep the birds in consequence of the habit they have acquired of repeating words; and a foolish piece of ignorance is sometimes productive of a good deal of cruelty in this particular

case. It is a vulgar belief, that they speak more plainly when their tongues are split, and much pain and annoyance is often occasioned to them by the performing of this operation. Now, there cannot be a piece of more gratuitous cruelty; for every one who knows anything about the structure of birds is perfectly aware that their tongues have nothing to do in the production or the modulation of those sounds which they utter, whether natural or acquired. The organ of voice in birds is at the bronchial end of the windpipe, and whatever of articulation they give forth is generated there, though the wind-pipe and mouth may act as a sort of trumpet in increasing the volume of sound, or otherwise changing the pitch of it.

Birds of this genus acquire a very considerable degree of interest, when we come to reflect on the part of their character now stated; and also when we take their usefulness into the account. Some of them at some seasons commit depredations upon the property of man, and destroy numbers of the eggs and young of birds, and also of the young of some mammalia, upon which man sets a value; but these are nothing to the good which they do in return; and it is doubtful whether, without the labours of birds of this genus, any country could be profitably cultivated, not only in so far as concerns plants which are reared for the sake of their seeds or grains, but also as concerns the meadows which are to be grazed. In some districts of Britain it has been felt by experience that the extermination of rooks is any thing but a prudent measure; and, although in many districts a price is set upon the head of the raven, it is questionable whether there be much more wisdom in that. The raven is, in a state of nature, one of the most retiring of the genus, because his habits are different from those of many of the rest; and, therefore, as is the case with the more powerful and predatory creatures of all classes, the raven retires naturally from those places where he is not immediately wanted. In the rich agricultural districts, and the wholesome and abundant sheep-walks, where all the stock is in good condition and free from disease, the raven levies no contribution, except upon such members of wild nature as do not fully participate in the benefit of man's cultivation, and, indeed, he seldom makes his appearance at all. It is generally said, in places where ravens are abundant, and where their manners should be best known, that among domestic animals, even in their young and helpless state, the raven scents nothing but disease. Now, it is well-known that in countries which are poor, badly cultivated, and subject to great variations of winter weather and winter feeding for domestic animals, those animals are not only liable to become diseased in the spring months, but many of their diseases very speedily infect the rest, till mortality becomes very general. These diseases, when they come to the infectious stage, are generally diseases of the alimentary canal, and before they come to this stage, the muscular strength is generally so far subdued that if they are out of doors at pasture, the diseased ones are not able to accompany the healthy, or even to rise up when they have lain down. It is in this stage that both sheep and cattle in exposed situations become ravens' food; and, indeed, in which they attract the notice of these birds; and when they attack calves or lambs, it will generally be found to be those that have been dropped by weakly mothers which are incapable of rearing them.

Thus, it will be found upon examination, that in most cases where there is a raven's portion, and a raven to take it, there is more advantage to what remains in its being so taken, than if it were left. We might easily go over the whole list of these *Corvidæ*, of which the habits are known with any degree of certainty, and show in a similar manner that, in a natural point of view, and even in reference to man's artificial modes of culture, they all do good, and not evil; but the limits within which we must confine this part of the subject, forbid us from saying any more, however interesting it might be to follow up the details. We shall, therefore, only farther mention the leading characters of a few of the principal species, taking those first which are best known in our own country, and commencing with the more powerful ones.

Corvus corax (the raven) is the largest and most powerful of all the species, measuring fully two feet in length, at least four feet in the stretch of the wings, and having the tail very firmly feathered, and equal in length to half the body. The plumage over the whole body is black, but glossed with blue reflections, which in certain lights give a very peculiar colour, which is known by the name of raven-grey; and in the extreme north the tint is apt to become paler than it is in warmer climates, and sometimes occasions the description of the bird as two species, whereas all over the world it appears to be the same, without any thing that can be regarded even as a variety.



Raven.

The raven lives in the wilds rather than in the woods, though it nestles in the latter, and builds at a very considerable elevation; and even on the ground, when it does not find other places which are better suited to its habits. When it has a proper choice, however, it prefers the ledges and clefts of rocks, not so high up, or in general in so exposed situations as those in which the eagle builds her eyrie, but rather on the margin of the cultivated grounds, or at all events in places where the vicinity affords plenty of food for it and its brood, which are very clamorous for their meals, and very voracious in the devouring of them. The gape of a young raven is very ample. The nest is formed externally of sticks, and lined with various matters, such as wool or hair. The eggs vary in number, rarely exceeding five, and being very often not more than two. They are of a sort of oil-green colour, with some markings of brownish ash. Ravens

are very attentive to their young and the old ones, which are understood to pair for life, that is, while both live—for no birds remain in widowhood, but pair again (if they can) when the season comes round—are very much attached to each other; they are never far apart, and if danger overtakes the one the other generally makes its appearance, and is not slow at giving assistance. The wariness of the raven makes it very rarely a prey to the stoop of the eagle, or the stroke of the more powerful falcons; and, at close quarters, these are not more than a match for the raven, if, indeed, they are as much. In some cases which have come within the knowledge of the writer of this article, a trained falcon (a peregrine, not a jer) has struck at and clutched a raven, but the raven so returned the clutch that, if assistance had not been given, the falcon would never have struck another bird; for, between the two, it appeared to be very equally “claw for claw,” as the saying is, and it is doubtful whether, if human aid had not come to the falcon, the two would not have been found dead together.

In former times ravens were by no means rare birds, in many, indeed in most parts of the British islands, and in various parts of the country, there was an allegorical saying, “every rock has its raven,” but they are now comparatively rare in England and in the south of Scotland, though there are some in even the eastern parts of the highlands, and more in the west highlands and the isles, where, in consequence of the greater abundance of humidity, and the consequent superiority of growth and abundance of life, they are by no means rare. From the first ridges of secondary hills at the south side of the base of the Grampians, there is, indeed, no want of ravens in most of the waste places, except in the more bleak and uninteresting moors, where there are no spots within many miles properly adapted for being their nesting places. In that part of the country they seldom if ever build in trees, because the principal woods there consist of pines, in which there is not much game suitable for the raven. But in the high and rugged rocks, especially when they have a southerly exposure, and copses and rich patches of land at the base, they are never wanting. In ravens' weather, that is, when the sky lowers and portends storms, or after the storm has just passed, they may be seen upon the more open parts of the woods, sitting on a dark mass of stone and eyeing the desolation around them with keen and cautious glance; and they sometimes vault up to a considerable height, and scan the wide and wild landscape from the top of the sky. They are not the most abundant of the crow tribe which we meet with in these lonely places, and they are not so social or so lively in their manners as most of the others; neither do they, in all probability, commit so many depredations on the nests and young of those birds which breed in the heaths and upland morasses as some of the others. But when you pass near those rocky places which are their favourite haunts and hiding places, it so happens that though you do not always see the raven, the raven always sees you; and he will steal along, by the side of your route, in the tractless desert for many miles, though when you get a sight of him, he appears always to be leaving you, and hopping away to a place in which he himself may be safe. This is done most readily and habitually when there is no sun, and the whole scene wears the dusky hue of the raven. And, though he appears to be always on the retreat, if you sit down you will soon find him

perched on some stone, with his tail towards you, but with the head turned back, and attending with the utmost watchfulness as to whether you are or are not in motion. If you make any demonstration against him, he will get on the wing with much apparent pain and difficulty, and seem as if he were marching off; but he has a curious way of "sideling" on the wing, by means of which he moves in the lateral direction, and gains on you at the end of his flight, even although he has seemed to be retreating all the time. If you wish to watch his manœuvres in the most perfect manner, or to tempt him within the distance of a shot, the best way is to lie down at full length on your back, and remain motionless. In such a case, if he is at a long distance when you take up your position, he will gain considerably on the wing, by more bold and decided flight than if you are merely sitting. But under no circumstances will he use the wing for the full extent of his reconnoissance; he will alight at a considerable distance, and even if you are so motionless that he feels confident of making a prey of you, he will still approach you in perfect conformity with the tactics of a siege, never upon the direct line, but at an angle, working by traverses more and more oblique as he comes nearer, so that when you observe him in motion, he is always as if he were passing by and regarding you with a mixture of fear and wonder. When he turns at the end of his traverse he stands for a short time as if he were irresolute, and at a loss which way to go, and seems studiously to avoid any appearance of design in his movements. But if you remain quite motionless, he will come very near; and should you allow yourself to doze during his crafty approach, the chance would be that your awaking might cost you an eye; and thus it is better for you to "have an eye" upon him. If you are provided with fire arms, and are inclined to add the useless carcass of a raven to the museum on the barn wall or the stable-yard at the inn, you may, if you have patience enough, make sure game of him; but if you fire and miss him, or if you start up when he is very near you, he mounts the sky, soon clears your horizon, and though you wait ever so long you see him no more.

The raven, when taken young, and the young, in consequence of their clamour, are easily discovered and procured if the nest is accessible (and when it is not, they often fall headlong and are found yelping in their discordant tone among the bushes), is easily tamed, and may be turned to account both as a scavenger and a watchman about tan-yards and other places where there is offal calculated to attract strangers. When these approach, the raven "gives tongue," or rather throat, and if they venture upon his ground, he appears to hop away with one of his legs crippled; but, watching his opportunity, he contrives to jerk himself, like a dart, at the enemy, and as his bill is both strong and sharp, a blow of it will send off a large cur howling. These tame ravens take fancies to, and against, persons, and other animals, for which it is by no means easy to account. Without any apparent difference of treatment received by themselves, they will welcome one party, appear to play with them, and never offer any violence; while there are others that they will strike and bite with great bitterness, even when they are fondled.

Ravens, though so voracious, that their name has been generally applied to all who are greedy of food or of any thing else, and not over nice as to the means by which they procure it, are capable of bear-

ing hunger for a very long time. They are so hardy that even in the wildest places, and those where they are most abundant, a dead raven, unless one which has been killed by man, is a very rare sight. They are also understood to be very long-lived, but the number of years is not ascertained. They must, however, be subject to some casualty, as the increase in numbers, in proportion to that of the eggs, is very small. There are ravens in most quarters of the world, if the state of the country is suitable to them, and there is little climatal difference, further than that those which are found in the high polar latitudes are pale in the colour.

We may farther mention as distinguishing features of this species, that the tail is very much rounded; that the feathers on the throat are narrow, sharp pointed, and raised; that those on the back part of the neck are soft and silky; that the bill and feet are black, and that the irides of the eyes consist of two circles of colour, the outer brownish, and the inner pale smoke grey.

Corvus corone, the carrion crow, or common black crow. This species is much smaller than the raven, being only about twenty inches in length, twenty-six in the extent of the wings, and eighteen ounces in weight; and as birds, to be equally well winged, should have the wings in the proportion of the cube-roots of their weights, it is not, in proportion, a bird of so powerful flight as the raven. The plumage of this species is entirely black, with few or no metallic reflections, or with them, of a dull green colour; the feathers on the throat being small and narrow, and the webs, toward their points, loose and flocculent; and the tail not so much rounded as that of the raven. Still, the bird has more the air of the raven than that of any other of the family, so that it may, except in colour, pass for a miniature of that bird, with the exception of the gloss of blue on the upper part of the true raven.

The carrion crow, as its name imports, is a foul and miscellaneous feeder. No garbage comes amiss to it, however rank; and it is by no means shy in the search of the offal of all sorts. For these reasons it is sometimes called the "dung-hill" crow, and, in Scotland, the "midden" crow; and it is *the crow*, throughout England. It is very generally distributed; but as the individuals are not in the habit either of flocking on their pastures, or of assembling in numbers to the same herding places, they do not make the same appearance as some of the other members of the genus.

Carrion-crows nestle in trees, generally in more retired places, and farther apart from each other than rooks. They generally pass the summer in extensive forests, from which they occasionally emerge to procure subsistence for themselves and their infant brood. They feed on flesh, eggs, worms, insects, and various kinds of grains; but they are particularly fond of carrion. In spring, they greedily devour the eggs of partridges and quails, and are so dexterous as to pierce them and carry them on the point of their bill to their young; even fish and fruit are not unsuitable to their palate. They often attack the eyes of dying animals, destroy weakly lambs, and, when pressed with hunger, will even pursue birds on the wing. They are notorious for the havoc which they occasion among game and poultry, and in rabbit warrens, where they kill and devour the young. When hens lay their eggs in hedge bottoms, or farm-yards, crows are often caught in the act of devouring them; but when they happen

to be satiated, they will frequently hide their food till hunger becomes more urgent. They have been observed to ascend with a crab to a considerable height and let it fall on a rock to break the shell, and then instantly pounce down upon it and bear it away for immediate consumption. In like manner, a friend of the late Dr. Darwin saw, on the northern coast of Ireland, above a hundred crows preying at once on mussels which they despatched by a similar process. Near the Cape of Good Hope they have been seen to dispose in the same way of land tortoises. We read too of an ill-starred philosopher, in ancient times, who was killed by an oyster impinging on his bald pate, which a crow had mistaken for a block of stone.

During the winter, these birds consort with the rooks and hooded crows, and sometimes intermingle with the latter, so as to give rise to a hybrid race. In this season, numerous flights of various species of the first genus assemble about our dwellings, keeping much on the ground, sauntering much about the flocks and shepherds, hovering near the tracks of the labourers, and sometimes hopping on the backs of pigs and sheep, with such apparent familiarity, that they might be mistaken for domestic birds. At night, they retire into the forests to lodge among the large trees, resorting to the general rendezvous from every quarter, sometimes from the distance of nine miles all around, whence they again sally out in the morning in quest of subsistence. As long as this association lasts, the hooded and carrion crows are observed to grow very fat, while the rooks continue always lean. Towards the close of winter, the latter also remove into other regions, whereas the carrion crows resort to the nearest large forests, where they pair, and seem to divide their territory into districts of about three quarters of a mile in diameter, each of which is allotted to the maintenance of its appropriate family, an arrangement which is said to subsist inviolate during the lives of the separate parties. The female lays from four to six eggs, of a bluish green, and marked with large and black spots, of cinereous grey and olivaceous, and weighing about five drachms each. She sits about three weeks, during which time the male supplies her with food.

The carrion crow often wages war with the lesser species of hawks; but it is especially courageous in the breeding season; nor will it suffer the kite, buzzard, or raven, to approach its nest with impunity. The young do not finally break off connexion with the parents till the commencement of a new brood. As they naturally attack small game, when wounded or exhausted, they have, in some countries, been bred for falconry, as in Turkey, where gentry of inferior quality paint them of different colours, carry them on their right hand, and call them back by the frequent repetition of the syllable *hoob*. Although their flight is neither easy nor rapid, they generally mount to a very great height, and indulge much in a whirling motion. Their croaking in the morning is said to indicate fine weather. As they are exceedingly cunning, have an acute scent, and commonly fly in large flocks, it is difficult to get near them, and still more so to decoy them into snares. Some of them, however, are caught by imitating the screech of the owl, and placing limed twigs on the high branches of a tree; or they are drawn within gun shot by means of an eagle-owl, or such other nocturnal bird, raised on perches, in an open spot. They are destroyed too, by throwing to them garden beans in

which rusty needles are concealed. They are likewise caught by cones of paper, baited with raw flesh. As the crow introduces his head to devour the bait, which is near the bottom, the paper, being besmeared with bird lime, sticks to the feathers of the neck, and he remains hooded; unable to rid his eyes of the bandage, he rises almost perpendicularly in the air, the better to avoid striking against any thing, until, quite exhausted, he sinks down, always near the spot from which he mounted. These, and other modes of ensnaring crows, are chiefly practised in the winter season, when the ground is covered with snow or bound up in frost, for then they more readily approach human habitations, and seek to pick up some subsistence from the dung of animals that have passed along the highways. But many of them are killed, at all seasons, in various parts of the continent, by strewing over the grounds which they frequent, pellets of minced meat, mixed with the powder of *nux vomica*.

The carrion crow appears to combine the dispositions of two or three other species of the genus. In form, in colours, and in its predatory habits, it resembles the raven; in restlessness and disposition to hoard, it has considerable analogy to the jack-daw; and in the last of these particulars, as well as in its general cunning, it has some traits of the magpie. It follows the general habit of the whole race in being easily tamed, and taught to repeat words without much difficulty. But still, it has peculiar characters, and belongs to a certain description, or a certain state of countries. It is not a bird of the perfect wilderness, an inhabitant of the open moor or the cliff; neither is it most favourable to those places which are in a high state of improvement. Wooded tracts, which are rather warm and fertile, but somewhat in a state of nature, are the localities in which it is most abundant; and if we are to assign it a topographical position, we may say, that its locality is intermediate between that of the raven and that of the rook. The raven, the carrion crow, the hooded crow, and the rook, may be considered as the typical crows, at least in Europe, and their localities are, the hooded crow, the raven, the carrion crow, and the rook, gradually approaching nearer the cultivated grounds.

Corvus cornix, the hooded crow, or, in some parts of the country, the "hoody." This species is considerably larger than the black crow; being about twenty inches long, forty in the stretch of the wings, and upwards of twenty ounces in weight, so that, with the exception of the raven, it is the largest of the crow tribe found in the British islands. Its localities are more peculiar than those of many of the others, but it is very generally distributed over the globe, and in some places of almost all latitudes it is *the crow*. In England, with the exception of some of the moors in the north, it is a winter visitant, not making its appearance before October, and departing in the spring. But in the north it is much more common, and continues all the year round. In the Lowlands of Scotland it is rather rare, though not quite unknown in any district; but in the Highlands, beyond the line of regular cultivation, it is almost the only crow that is known, with the exception of the raven. It is a strong bird and a powerful flier, and ranges over the moors and mountain bogs, levying very heavy contributions on the nests and young of ground birds, which breed in those places; and when the snow is on the ground, so that it finds but little food inland, it resorts to the shores of the sea and

picks up whatever it can find in that all-productive locality.

It is easily known by its colour, which is smoke grey, with the exception of the head, throat, wings, and tail, which are black, with reflections of a green colour, but more inclining to blue than those of the black crow. It is the contrast of the black on the head with the grey on the back which procures for this species the name of the hooded crow. The hood is not so conspicuous in the female as in the male, because the black is not so deep nor the grey so pale; but the common opinion that the female is without the grey is not correct. The bill is black, but rather paler at the tip, strong and arched in the culmen, bearing a considerable resemblance to that of the raven. The feet are also black, the skin of the tarsi being plated. In the grey parts the shafts of the feathers are black, and the grey is subject to considerable varieties of shade, depending, in part at least, on the latitude and the season; and albinos, or at all events, specimens in which only the shafts of the principal feathers are black, are occasionally to be met with.

Though this species appears in England only in the winter, it is not to be considered as a regular climatal migrant retiring from the northern latitudes during the winter; for it winters as far to the north as the Faroe Islands, and the isles on the coast of Norway, where the shores remain clear of ice during the winter. Those which resort to England and other champaign countries of Europe, where they do not remain during the summer to breed, must therefore be considered as driven from the wilds of Lapland by the want of food. The resort of ground building birds to these wilds during the summer is very great, and hooded crows find an ample supply of provisions in the eggs and callow young; but when the snow falls, or there is not scope and food for them all on the sea-coast, numbers seek their way to more southerly climates.

But it must not, on the other hand, be considered that these birds have any partiality for northern latitudes, other than that they find food plentiful there in the summer season; for they are very generally distributed in all places where there is food for them; and they are the common, or at all events the most frequently seen species of crow in many parts of India, especially in the wild districts near the Runn of Cutch; and we may remark that, generally speaking, where hooded crows remain in large numbers to breed, in whatever latitude it may be, carrion crows and rooks are rarely to be met with. The absence of timber, in such collections as to admit of rookeries, and of such closeness as to hide the nest of the carrion crow, may be partly the reason of this; but still it is doubtful whether it will account for the whole difference. The hooded crow is, for instance, the only crow known in the Shetland and Orkney Islands, and in those wild districts both of the highlands of Scotland and of Ireland, where there are no timber trees; but there are also well wooded districts in the highlands, in which, though hooded crows are abundant, not a single rook or carrion crow is to be seen, though in the lowland districts, distant only a few miles, rooks are abundant, and hooded crows appear only as stragglers. A person passing for the first time from the land of rooks to that of hooded crows, which is nearly synonymous with passing from the country of lowland Scotch to the country of Gaelic,

is apt to imagine that the crows speak a new language as well as the people; for the sound of the rook, if not musical, is at least loud and clear, while that of the hooded crow is at once hoarse and feeble, as if it were a jackdaw attempting to mock the croak of a raven.

Where opportunities offer, the hooded crow breeds in the pines and other large trees, in default of which it nestles in the cavities of rocks. The female, which is rather smaller than the male, and of less lively hues, usually lays four, five, or six eggs, of a greenish blue, marked with many spots of blackish brown. It pairs during the whole of the breeding season, and both parents are much attached to their offspring. They are remarked for their double cry, of which one is hollow and well known, and the other shrill and somewhat resembling the crowing of a cock. When other food is wanting, they will eat cranberries and other mountain fruits; in open fertile countries, they live much on grain, worms, and carrion; but they often resort to the sea shores, and prey on the various animal matters thrown up by the tide. Frisch observes that they are expert at picking fish bones, and that when water is discharged from ponds they quickly perceive the fish which are left in them, and lose no time in darting on them. They not only attack the eyes of lambs and diseased sheep, but of horses that have got entangled in bogs. In the Faroe Isles, where they abound, they are particularly mischievous, picking the seed from the fields, digging up the newly-planted potatoes, destroying the barley before it is ripe, and carrying off goslings and ducklings, or the fish which is hung up to dry, to their young.

Corvus frugilegus (the Rook). This species, which is to the inhabitants of well cultivated countries the most interesting of the whole genus, is about the same length as the hooded crow; but it is lighter made, and, when full grown, rather longer in the wings. Its bill too is of a character entirely different, being nearly straight, and having much less of the predatory character than that of any of the three species which have been mentioned. Its bill is bluish black, with a portion of the skin at the base bare of feathers in the full-grown birds, and covered with a scaly scurf of a whitish colour; but in the young birds this portion is covered with feathers, which are projected a little way over the base of the bill. The whole of the plumage is black, but glossed with reflections of purple, violet, and blue, which are very rich and beautiful when the bird is in good condition. The legs and claws are also generally of a black colour. Sometimes, however, but not very often, these birds are subject to variations, not only in the plumage, but in the bill, the claws, and the naked skin. Some are pure white, others piebald, others yellowish, and in these cases the bill, feet, and claws, are generally of a flesh red, but there is always a trace of darker colour in the principal feathers of the wings and the feathers of the tail. Specimens which have these varieties of colour cannot be considered as permanent varieties, and they do not perpetuate their colours in their progeny, neither is it known whether they breed, though it is presumed that they do not. These variations are very rare, compared with the numbers of the birds; and their cause is altogether unknown. The rook is a native of most of the temperate regions of Europe, but is not found much farther north than the south of Sweden, where it breeds, but from which

it is driven by the severity of the winter. In Russia and the west of Siberia, it is far from rare, emigrating early in March to the environs of Woronetz, and mingling with the common crows. In England they are stationary, but in France, Silesia, and many other countries, most of them are birds of passage. In France they are the forerunners of winter, whereas in Siberia they announce the summer. Their flights are sometimes so dense as to darken the air, being frequently joined, not only by the common crow and jackdaw, but also by troops of starlings. Every spring they resort to breed on the same trees, preferring the loftier branches, and building sometimes ten or twelve nests, which are one above another on the same tree, whilst a great many trees thus furnished occur in the same forest, or rather in the same district. They seek not retirement and solitude, but rather settle near our dwellings. When a pair are employed in constructing the nest, one remains to guard it, while the other is procuring the suitable materials; for otherwise the structure would, it is alleged, be instantly pillaged by the other rooks which have fixed on the same tree, each carrying off a twig to its own dwelling. Rookeries are sometimes scenes of violent contests between the old and the new inhabitants, whether the intruders be of the same or of different species. A pair which had in vain attempted to establish themselves in a rookery at no great distance from the Exchange of Newcastle-upon-Tyne, having been compelled to abandon their purpose, took refuge on the spire of that building; and though constantly interrupted by others of their own species, succeeded in completing their nest at the top of the vane, and reared their young, apparently regardless of the noise of the people underneath. The nest and its inhabitants were in course turned round by every change of wind, and yet the parents persevered in maintaining the same position for ten years, when the spire was taken down. As soon as rooks have finished their nest, and before they lay, the male begins to feed the females, which receive their bounty with a fondling tremulous voice, fluttering wings, and all the little blandishments that are expected by the young while in a helpless state. This gallant deportment of the males is continued through the whole season of incubation. The female lays four or five eggs, which are smaller than those of the raven, but marked with broader spots, especially at the large end. After the young have taken wing there is a general deserting of the nest trees, but the families return again to them in October to roost, and to repair their dwellings. On the approach of winter, however, they usually seek some more sheltered situation at night, but generally assemble first in the usual place, and then fly off together. Their autumnal exercises of departing on their foraging excursions in the morning, and returning in the evening, are familiar to ordinary observation, and have been well described by White and others. Though the forest may be said to be their winter habitation, they generally visit their nurseries every day, preserving the idea of a family, for which they begin to make provision early in spring, the business of nidification being usually accomplished in the month of March.

The rook has but two or three notes, and makes no great figure in a *solo*; but when he performs in *concert*, which is his chief delight, these notes, though rough in themselves, being intermixed with those of the multitude, have, as it were, their ragged edges

worn off, and become harmonious, especially when softened in the distant air. So marked is their dread of a fowling-piece, that the country people allege they even smell gunpowder; but, if the gun be carefully concealed from their view, a person with his pockets full of gunpowder may approach very near them. Among the favourite articles of their food is the grub of the chafer, or beetle, which, if allowed to multiply unchecked, would lay waste whole meadows and cornfields. It must not be dissembled, however, that rooks themselves are sometimes very injurious to new sown wheat, just when it begins to germinate. The severity of winter, when accompanied by a heavy fall of snow, sometimes drives them down to the sea-shore, where they are observed to feed on small shell-fish, particularly the common periwinkle. Having raised these last into the air, to about the height of fifty feet, they let them fall among stones, stooping instantly after their prey. If the shell is unbroken, they lift it again and again; and when the wind happens to carry it out of the perpendicular direction, they toil much and gain little. Frauds in the mode of procuring their livelihood, as well as in that of building their nests, are sometimes attempted among them, but which, when discovered, meet with instant and condign punishment. Indeed we can scarcely doubt that these sagacious birds have ideas of property, unknown to many of the inferior animals, as each pair, year after year, assert their claim to the same nest; and an attempt to invade them, on the part of others, would, as often happens, be punished not merely by the aggrieved individuals, but by the combined efforts of the society, which clearly proves that they consider it as an offence against the community. When tamed they evince both confidence and attachment.

The young of this species are, by some, reckoned good for the table, but those habituated to better fare will probably esteem them somewhat coarse. In order to be at all edible, they must be skinned, and, even then, they are exceedingly bitter, and not very nourishing; but the abundance in which they may be had where there are extensive rookeries, renders the shooting of them when they are "branched," that is, when they have left the nest but not taken to the wing; rather a favourite exploit with the more humble description of sportsmen. The sport is, however, both cowardly and cruel, not greatly superior to that of shooting pigeons from a trap; and the lamentations which the parent birds make over their slain progeny are not only painful to hear, but have a very strong expression of reproach in them; and the feelings thereby produced are not lessened when we consider the perfect confidence with which rooks congregate near human habitations, and the great services which they render to the cultivator.

Corvus monedula, (the Jackdaw), or steeple crow, called in Scotland the *kae*, which is very nearly the sound of its natural voice. It is about fourteen inches in length, twice as much in the stretch of the wings, and weighs about nine ounces. The head is black, the nape of the neck is smoke grey, the back greyish black; the wing-coverts and secondary quills black, with violet reflections; the under part bluish black; the bill and legs also black, and the irides whitish grey. This species is noisy, and, when tamed, it is mischievous; but in its general habits it resembles the rook, in rarely plundering the nests of other birds, but rather feeding upon insects, worms, and various sorts of seeds.

The jackdaw, though it affects peculiar localities,

and chiefly towers in cliffs, is not absolutely confined to such places, even in its nest-building. It is also very generally distributed over Europe, stationary in some countries, but migrant in others, without any uniform regard to difference of latitude. On the extreme north of Europe it is indeed only a summer visitant, there being no food for it in the winter. In Sweden it is found pretty far to the north. It winters about Upsal, and passes the night in large flocks in ruined towers, especially those of the old town. It is common all over Russia and Western Siberia. In the south of Russia, and in Great Britain, it is stationary throughout the year; but in France, some parts of Germany, and other places, it is at least partially migratory, though a number of them continue in these countries during summer. Such of them as migrate form themselves into large bodies, like the rooks and hooded crows, whose phalanxes they sometimes join, continually chattering as they fly. Yet they observe not the same periods in France and in Germany, for they leave the latter in autumn, and appear not again till the spring, after having wintered in France. In general they frequent old towers, ruined buildings, and high cliffs, but they also occasionally breed in the holes, and even on the branches of trees, especially if in the neighbourhood of a rookery. In some parts of Hampshire, owing, probably, to the want of towers and steeples, they frequently build in the burrows of a rabbit-warren; and in the Isle of Ely, from a similar cause, they take up their abode in chimneys. Their nest is made of sticks, and lined with wool and other soft materials, and the eggs are generally five or six, smaller and paler than those of the crows, of a bluish or greenish ground, spotted with black or brown. After the young are hatched, the female watches, feeds, and rears them with an affection which the male seems eager to share. Some authors affirm that they have two broods in the year, but this, we have reason to believe, is by no means uniformly the case. During the season of courtship they prattle incessantly, woo each other's society, and even kiss. Even in captivity they refrain not from these marks of tender attachment. Many pairs usually nestle in the same neighbourhood. They feed principally upon worms and the larvæ of insects, and are very fond of cherries. Their voice is shriller than that of the rook or crow, and appears to be capable of different inflexions. They are easily tamed, and seem so fond of domestication as seldom to attempt their escape. They may be fed on insects, fruit, grain, and even small pieces of meat. With no great difficulty they may be taught to articulate several words; but they are mischievous and tricky, and will secrete not only portions of their food, but pieces of money and jewels.

Corvus pica, or *Pica melanoleuca* (the Magpie). This is a species with lively colours, the peculiar attitudes, the prying disposition, and the familiar manners of which every body is acquainted with. Its length is about eighteen inches, but great part is taken up by the tail, and the body is rather short and round; the extent of the wings is about two feet, and they are broad and rounded, and better adapted for ascending and descending than for long flights, upon which the bird flies with rapid movements of the wings, and apparently with difficulty. The weight is about nine ounces; the bill and legs are black; and the irides deep and bright brown, which gives very

considerable expression to the eye. This is altogether one of the most beautiful of British birds, and if it were not so common it would be very much admired. Its colours are black, with purple and green reflections; the scapulars, breast, belly, and inside of the wing-feathers, white; tail lengthened and wedge-shaped; the black, especially on the feathers of the wings and tail, exhibits, in certain dispositions of the light, very fine reflections of green, blue, purple, and violet, a circumstance of which superficial observers are little aware; nor can he who has only examined a dirty specimen, in confinement, form any adequate notion of the native beauties of the bird. It is about eighteen inches long, twenty-four in extent of wing, and weighs between eight and nine ounces. The female differs from the other sex only in being somewhat less, and having a shorter tail. Among the more remarkable varieties to which it is occasionally liable, we may notice that of whiteness almost pure, cream or buff colour, and white streaked with black.

The magpie is generally diffused in England, France, Germany, Sweden, and most of the countries of Europe; and it also occurs in Asia as far as Japan, in China, as well as in Siberia, Kamschatka, and the adjacent islands, whence it has possibly passed into the northern parts of America, for it is seen, though rarely, in Hudson's Bay, and on the borders of the Mississippi. In Europe it is found as far north as Wardlines, and as far south as Italy; but it seldom abounds in hilly regions. Being smaller than the rook, and with wings proportionally shorter, its flight is neither so lofty nor so well supported; neither does it undertake long journeys, but only flies from tree to tree, at moderate distances; yet it is seldom at rest for any length of time, but skips and hops about, and shakes its long tail almost incessantly. Though naturally shy and distrustful, yet it is seldom found remote from human habitations. Magpies generally continue in pairs throughout the year; and if they sometimes unite into small flocks, it is only for some temporary purpose. They are clamorous and mischievous, reject hardly any species of animal food or fruits, and devour grain when nothing else is within their reach. They will prey on birds caught in snares, on nestlings, rats, field-mice, young poultry, leverets, feathered game, carrion, fish, and insects. Lambs, and even weakly sheep, they attempt to destroy, by first plucking out their eyes. They are notorious pilferers and hoarders, and will conceal either provisions, or any glittering objects, with great address, pushing them into holes until they are no longer visible. Their winter store of food is usually collected in the middle of a field, and is sometimes indicated by two of the species contending for the hoard. Though crafty, they are also familiar; and though naturally addicted to chatter, they are still more so when tamed and attached; so that, especially when taken young, they may be taught to pronounce words, and even short sentences, and will imitate any singular noise. In their natural state they proclaim aloud any apparent danger, insomuch that no fox, or wild animal, can appear without being noticed and haunted; and thus even the fowler is frequently deprived of his sport, for all birds seem to know the magpie's alarming chatter. The nest, which is placed on the top of a tree, in a thick bush or hedge, and sometimes at no great distance from the ground, bespeaks much skill and artifice. The male and female work at it

conjointly, or alternately, beginning in February, and usually continuing their labours for six weeks or two months. It is, for the most part, constructed on a fork, or on a junction of branches, and composed of twigs, young shoots of trees, and a thick covering of leaves, strengthened outwardly with long and flexible sticks, plastered over with mud, the upper part being covered with thorny branches, closely matted, so as to secure a retreat from other birds intruding, a hole being left at the side scarcely large enough for the admission and egress of the parent birds. The inside is furnished with a sort of mattress, composed of the fibres of roots, wool, and other soft materials, being only six inches in diameter, whereas the whole edifice measures at least two feet in every direction. Should the eggs be destroyed, the female abandons a construction which had cost her and her partner so much trouble, and will lay a second, and even sometimes a third time, if again disturbed, the number of eggs diminishing at each hatch. On these occasions she does not build a new nest, but takes possession of, and refits, an unoccupied one that has belonged to a rook, or else finishes one of those imperfect structures which are occasionally to be found in her neighbourhood, as if purposely reserved for cases of emergency. But, if unmolested, there is but one brood, which generally consists of seven or eight. The eggs are of a bluish or pale green, spotted with brown, and cinereous. The male and female incubate alternately, and in the course of about fourteen days the young are brought forth blind, and continue so for some days. The parents rear them with great solicitude, and for a considerable length of time. During winter nights, magpies assemble in great numbers in some coppice or thicket to roost, but they separate again in the day-time. When the young are taken from the nest for training, they may be fed with bread, curdled milk, or new cheese. Their flesh is considerably inferior to that of the young rook. In almost every country, the appearance of the magpie is, in the minds of the vulgar, associated with superstitious and ominous notions.

The prying, pilfering, and nest-plundering propensities of the magpie, sometimes subject it to a little temporary inconvenience at the hands of boys, especially where it has young in a thick tree near the house. An egg is emptied of its contents by blowing, and then filled with bird-lime, and laid in some place where it may be seen by the magpie; and as "Madge" has all her eyes about her, and knows most of what is within the range of her observation, the exposure of the egg out of doors is as easy a matter as the concealing of it. She soon approaches, watchful of any one who may be observing her, but intent upon the egg. After a hop or two in various directions, to see that all is safe, she dashes her bill into the egg, in the usual way of carrying the larger kinds of eggs to her brood; but as the shell is already broken, the bill penetrates up to the eyes, and the shell adheres, and acts as a blind. She takes flight, however; but, as she cannot see her way, she flies bumping against the twigs, and often cuts a very ridiculous figure before she can so disentangle herself from the shell and the bird-lime as to be able to see her way.

When magpies are holding those councils, or "folk-motes," for which they are so remarkable, a scene of great consternation ensues among them if one of the more powerful hawks come in sight, or if

a falcon is flown over them. All chattering and hopping is instantly at an end, unless there are bushes into which they can creep; and when they are within reach of no such shelter, they remain motionless on the ground; though, in places where large hawks frequently appear, they select their rendezvous in some spot which is closely surrounded by broom or furze, or some other cover. As long as the hawk or falcon remains in sight, the whole powers of the magpies seem to be absorbed in the dread of it; for they may be knocked down with a stick with little attempt to escape, or taken with the hand without offering any resistance. But we must close our notice, for there is really no end of the stories that might be told of this very curious bird.

Corvus glandarius (the Jay). In some respects the jay stands nearly in the same relation to the magpie that the carrion crow does to the rook. It is a woodland bird, never found in open and treeless places, and very seldom near houses. In the woods it chooses the thickest shades; and though its chatter is often heard, it is less frequently seen than almost any other bird of the same size and equally numerous. It occurs in all parts of the British islands where there is cover for it, and it has an original name both in Welsh and Gaelic, both of which have the same meaning, "wood-screacher," or "wood-screamer;" and some systematists have made it the type of a separate genus, under the name *Garrulus*.

The jay varies a good deal in size with the nature of its haunts, being much smaller in Scotland than in England. Its mean dimensions may be taken at about a foot in length, eighteen or nineteen inches in the stretch of the wings, and about seven or eight ounces in weight.

The bill of the jay is dusky, the legs brown, and the irides of a glistening pearl grey, which gives a sharp and irritable expression to the eye. The head is whitish, with black streaks, and the feathers on the top of the head are loose, and form a crest which is erectible at pleasure. The body is wine buff, or a mixture of yellow, red, and brown, so melted into each other, that the whole effect is not easily described. The lesser coverts of the wings are pale bay; the greater coverts are marked with traces of black and rich blue. The secondary quills next the body are bay, with black tips, the next two are entirely black, and the remaining ones are black, tinged with blue, and having white on their outer neeks, near the base. The rump and tail coverts, both upper and under, are white, and the tail feathers black. These birds, though they keep in the cover of the woods, are very active and very voracious. They are omnivorous, consuming great quantities of nuts, mast, wild cherries, peas, and other products of the wood and its vicinity; they are also great robbers of the nests of smaller birds, and they sometimes kill and eat the birds themselves, and also mice, and the larger insects. They are in fact always prying about in the warm season, and very often eating. It is usually said that they are in the habit of hoarding their vegetable food against the season of want; and it may be true, for there are a good many more birds which form magazines than we are usually in the habit of giving credit for being so provident. But, in the case of the jay, this is not easily established by actual observation, as it is by no means easy to see what they do; and though they are found making free with a store, it cannot, on

account of their habits, be thence inferred that this store is their own. In confinement they do conceal their surplus provisions, but they at the same time pilfer and hide substances which can be of no use to them as food; so that no certain conclusion can thence be drawn of what they may do in a state of nature; and magpies and jackdaws both hoard and steal when in a domesticated state, and yet we do not hear of their stores of provisions being met with when they are in the wild state. In winter, too, at least in the colder parts of the country, jays are understood to be, for the greater part of their time, in holes of trees, or other places of concealment, in a state nearly dormant. It is not supposed that they actually hibernate, but they are rarely seen at that season when there are no leaves on the trees to conceal them; and when they do make their appearance in winter, it is only on very mild days.

When any danger appears, the jays set up a screaming, and as their chattering is loud, and they all take up the note, they alarm the whole tenants of the wood, and thus, by acting the part of sentinels, make some sort of return to other birds for the depredations which they commit on their nests. On some parts of the continent they are partially migrant, and where this is the case they partially flock, though their flocks can hardly be called societies. In Britain they are more stationary, generally remaining in the same places, and rearing two broods in the course of the season. They choose the most close and concealed parts of the trees for their nests; and, both for general habitation and nesting, they prefer young woods, in which the trees are branched down nearly to the ground, to those which have tall and clean boles. Rooks and jays may be found in the same forest, but not in the same part of it. The nest is not so elaborate a structure as that of the magpie. It is broad, and rather firm, as well as carefully concealed; but it has no dome, and is shallow, and without any very soft matters in the lining. The eggs vary from four to seven, are smaller than those of the pigeon, of a greenish-grey colour, with olive spots. The time of the incubation is understood to last about two weeks.

When the jay has grown to maturity in the wild state, it is very shy as well as cunning, and can hardly be reconciled to confinement by any means; but when it is taken young, it is very easily tamed, and very docile, though even then it appears at times to be very impatient of the confinement of the cage, against which it breaks its feathers, and often does itself more serious injury. But it articulates readily, can be taught a number of tricks, and therefore, in many parts of the world it is kept with much attention. Its voice is flexible, and it is capable not only of articulating words, but of imitating the voices both of other birds and of several of the mammalia. For food it is of little value, as it is both tough and of bad flavour; but on some parts of the continent it is eaten, after having undergone the double culinary process of being first boiled and then roasted. Even if it were good, the labour of obtaining it in Britain would be far more than its value; but on the continent it is more easily obtained; and though it is not in request for the table under its own name, it is said to be sometimes double-cooked, as above-mentioned, and then introduced as a thrush.

Corvus graculus (Chough). This species, which is called the Cornish crow, the red-legged crow, and

various other names, is an inhabitant of peculiar localities, but these localities are situated in many latitudes, and they are sometimes on the sea-coast, and sometimes inland. In all places, however, it appears to be a rock-bird, though not an inhabitant of all rocks indiscriminately, or even of all rocks which appear to be in themselves of nearly the same character.

In Britain the chough is found only on, or very near, the coast, and on those coasts only which are washed by the Atlantic and the Channel, and not upon these, if there are not rocks or lofty ruins to serve it for nesting-places. Dover and Cornwall, some parts of Wales, and a few spots on the west coast of Scotland and the Hebrides, are the British localities of the chough. It occurs as far to the north as Norway, and in the rocky mountains of central and southern Europe, in the Alps, the Pyrenees, &c. It is also found, at least at some seasons of the year, in places where there are few or no rocks, being particularly abundant along the banks of the Nile in Egypt, when the inundations begin to subside, and the supply of reptile food becomes abundant; but it does not breed on the banks of that river.

The chough is black, with a tinge of violet; and the bill and legs are red. The irides are hazel. The bill is differently shaped from that of any of the previously mentioned species of the genus, being longer in proportion, more slender, and bent for nearly the whole length, though only slightly. It is also much weaker, being brittle, and therefore not adapted for the hard labour to which the bills of some of the others are subjected. Of course it is used for different purposes, and the form and texture of the bill, together with the character of the haunts in which it is chiefly found, may help to guide us to the particular nature of its food, and consequently to the part which it performs in the economy of nature. The character of the feet is also of some importance; they are very stout, or at least clean made for the size of the bird, and the claws are crooked and sharp, partaking a little of the prehensile character.



Chough.

Thus the bill of the chough is not adapted for digging into the ground, or for pushing and breaking hard substances, like the bills of most others of the genus, nor are its feet adapted for scraping; it must therefore be a surface feeder, and its food animal or soft vegetable matter, or both. There are many small animals on the bank of the river which has been inundated, for the mud in such places, if the

climate or even the weather for the time is hot, becomes absolutely alive; and there are many similar creatures on the ocean strand, where the ebbing and flowing of the tide occasions something like an inundation, and its departure twice every day. Besides the animal food which it finds in those places, the chough is said to be very fond of those wild berries which are generally abundant in the humid or marshy parts of the uplands, and these furnish it with at least a seasonal supply. Scopoli mentions that choughs feed much upon juniper berries, which, as they take a long time in growing, and are in several successions upon the bushes at the same time, continue ripening for a longer period, and are ripe more in the dry season than the annual crops; and they are followed by the *vacciniums* and other berries of swifter growth and shorter harvest. In this the chough follows the same practice as the crows in the mountainous parts of our own country, which may be seen in the mountain marshes and other places which abound with berries after the nesting is all over, and there is little for them to plunder in the more dry and heathy parts of the moors.

Choughs take a good deal of care in the construction of their nests. These are usually formed in the crannies of the rock, about midway up the cliff, so as to be out of the reach of danger both from below and from above. There are a good many materials used, sticks to form the frame-work, and then a copious lining of wool, hair, or other soft matters, as may happen to be within the reach of the birds. The eggs are usually about four or five in number, rather larger than those of the jackdaw, of a dull white colour, with spots of ash colour and pale brown, which are most abundant at the larger end.

Choughs seldom come abroad in stormy weather, but they are much on the wing when it is fine, flying high to and from their feeding grounds, and often uttering their cries, which are more shrill and wailing than those of jackdaws. They are very easily tamed, and get familiar and even attached to those with whose appearance they are familiar; but they are not fond of strangers. The difference of their notes to those they know and those they do not are worthy of attention to their acquaintances. Their tones of address are soft and even coaxing; but they utter a very harsh alarm note when any one whom they do not know approaches them. As is the case with all the race, they are very apt to steal and secrete pieces of money and other shining substances; and in cottages, where sticks are burnt, they are apt sometimes to seize little pieces which are on fire at one end, and fly about with them in a way not altogether safe.

Corvus caryocatactes (the Spotted Crow or Nutcracker.) This species is not uncommon on the continent of Europe, and it generally appears there in flocks; but in Britain it occurs only in straggling specimens, and that very rarely. It is a very handsome bird, about the size of a magpie, or about thirteen inches long, and a foot and a half in the stretch of the wings. The general colour of the body is dusky brown, all marked over with triangular white spots. The crown of the head, the wings, and the tail, are blackish, the latter marked with white at the tip, and the middle feathers with the ends of their webs ragged and incomplete.

There are some points of resemblance between the nutcracker and both the magpie and the jay; but the bill is of a different shape, the mandibles being

straighter, blunter at the point, and of unequal length. Its attachment to localities is also different. It comes not near houses, like the magpie, neither does it dwell in thick woods and copses on the rich grounds. It is more of a mountaineer, seeking the forests upon the elevated slopes, nestling in holes, and finding the chief part of its food in the kernels of trees, nuts, acorns, beech mast, the seeds of the coniferæ, and other vegetable substances, which, in consequence of the hardness of their envelopes, remain on the ground as a store for nearly the whole season. The hardest of these it can readily break, and it is for this reason that it is called the nutcracker. From the retired nature of its habits in keeping to the wild woods at that season when the knowledge of it would be most interesting, very little is known of the domestic economy of the nutcracker; and all that is known in Britain, save the mere appearance and colour of the bird, judged of from a casual straggler or a museum specimen, is at second hand. It is alleged by Klein, and some other of the continental describers, that there are two varieties, or even species, in the Alpine forests of central Europe—one with the bill strong and angular, and the tongue long, and forked; and another with the bill rounder and weaker, and the tongue also divided at the tip, but much shorter than that of the former. It is further said that the one with the angular bill and the long tongue fairly breaks the shells of the nuts; while the other merely pierces them and extracts the kernel through the opening. Their nests are in the holes of trees; and when they do not meet with these to suit their purposes, they are said to make them, or at all events to work them to the desired shape; but, as we have already noticed, their habits are imperfectly known. The eggs are said to be about five or six in number, of a greyish fawn colour, and marked with spots of clear brown.

The nutcracker is not understood to have so much cunning, or to be so much of a thief, as the magpie or the jay, though it is described as still retaining the omnivorous character, and sometimes varying its food by making a meal of another bird, the skull of which it very quickly hammers to pieces with its powerful bill. Adult birds of this species are said not to be tameable, as they obstinately refuse to take food; but young ones can be tamed with nearly the same facility as others of the genus. In confinement they are said to be given to hoard and pilfer like the rest of the tribe, but whether they have this habit when in a state of nature is not known.

On the continent this species is very generally distributed, being found not only on the wooded mountains of Europe, but in Siberia, as far as Kamtschatka. Seasonally they leave the woods, and appear in considerable flocks, and in the flocking season they are often seen both in Germany and France.

There are very many foreign species, either belonging to this genus or very nearly allied to it, in almost every part of the world; but we have not room for even a mere catalogue of the whole; and their manners, in so far as they differ from those of the species already noticed, are so little known that they could not easily be made interesting to the general reader. We shall therefore close this very imperfect sketch by a mere notice of one or two of the most remarkable species.

Corvus cristatus—*Garrulus cristatus* of Cuvier (the Blue Jay of America). This is a very beautiful species, resembling, in many of its habits, the common

jay of Europe. It is very generally distributed over at least the more temperate parts of North America; and we cannot bring it so well before the reader as in the language of that prince of all ornithologists, Alexander Wilson.

"This elegant bird," says this eloquent child and worshipper of wild nature, "which, as far as I can learn, is peculiar to North America, is distinguished as a sort of beau among the feathered tenants of our woods by the brilliancy of his dress; and like most other coxcombs, makes himself still more conspicuous by his loquacity and the oddness of his tones and gestures. The jay measures eleven inches in length; the head is ornamented with a crest of light blue or purple feathers, which he can elevate or depress at pleasure; a narrow line of black runs along the frontlet, rising on each side higher than the eye, but not passing over it; back and upper part of the neck a fine light purple, in which the blue predominates; a collar of black, proceeding from the hind head, passes with a graceful curve down each side of the neck to the upper part of the breast, where it forms a crescent; chin, cheeks, throat, and belly, white, the three former slightly tinged with blue; greater wing-coverts, a rich blue; exterior sides of the primaries, light blue, those of the secondaries a deep purple, except the three feathers next the body, which are of a splendid light blue; all these, except the primaries, are beautifully barred with crescents of black, and tipped with white; the interior sides of the wing-feathers are dusky black; tail long and cuneiform, composed of twelve feathers of a glossy light blue, marked at half inches with transverse curves of black, each feather being tipped with white, except the two middle ones, which deepen into a dark purple at the extremities. Breast and sides under the wings a dirty white, faintly stained with purple; inside of the mouth, the tongue, bill, legs, and claws, black; iris of the eye hazel.

"The blue jay is an almost universal inhabitant of the woods, frequenting the thickest settlements as well as the deepest recesses of the forest, where his squalling voice often alarms the deer, to the disappointment and mortification of the hunter; one of whom informed me, he made it a point, in summer, to kill every jay he could meet with. In the charming season of spring, when every thicket pours forth harmony, the part performed by the jay always catches the ear. He appears to be among his fellow musicians what the trumpeter is in a band, some of his notes having no distant resemblance to the tones of that instrument. These he has the faculty of changing through a great variety of modulations, according to the particular humour he happens to be in. When disposed for ridicule, there is scarce a bird whose peculiarities of song he cannot tune his notes to. When engaged in the blandishments of love, they resemble the soft chatterings of a duck, and while he nestles among the thick branches of the cedar, are scarce heard at a few paces distance; but he no sooner discovers your approach than he sets up a sudden and vehement outcry, flying off, and screaming with all his might, as if he called the whole feathered tribes of the neighbourhood to witness some outrageous usage he had received. When he hops undisturbed among the high branches of the oak and hickory, they become soft and musical; and his call of the female a stranger would readily mistake for the repeated squeakings of an ungreased wheel-

barrow. All these he accompanies with various nods, jerks, and other gesticulations, for which the whole tribe of jays are so remarkable, that with some other peculiarities they might have very well justified the great Swedish naturalist in forming them into a separate genus by themselves.

"The blue jay builds a large nest, frequently in the cedar, sometimes on an apple tree, lines it with dry fibrous roots, and lays five eggs of a dull olive, spotted with brown. The male is particularly careful of not being heard near the place, making his visits as silently and secretly as possible. His favourite food is chestnuts, acorns, and Indian corn. He occasionally feeds on bugs, caterpillars, and sometimes pays a plundering visit to the orchard, cherry rows and potato patch; and has been known in times of scarcity to venture into the barn, through openings between the weather boards. In these cases he is extremely active and silent, and, if surprised in the fact, make his escape with precipitation, but without noise, as if conscious of his criminality.

"Of all birds he is the most bitter enemy to the owl. No sooner has he discovered the retreat of one of these, than he summons the whole feathered fraternity to his assistance, who surround the glimmering *solitaire* and attack him from all sides, raising such a shout as may be heard in a still day more than half a mile off. When in my hunting excursions, I have passed near this scene of tumult, I have imagined to myself that I heard the insulting party venting their respective charges with all the virulency of a Billingsgate mob; the owl meanwhile returning every compliment with a broad goggling stare. The war becomes louder and louder, and the owl at length, forced to betake himself to flight, is followed by his whole train of persecutors, until driven beyond the boundaries of their jurisdiction.

"But the blue jay himself is not guiltless of similar depredations with the owl, and becomes in his turn the very tyrant he detested, when he sneaks through the woods, as he frequently does, and among the thickets and hedge rows, plundering every nest he can find of its eggs, tearing up the callow young by piecemeal, and spreading alarm and sorrow around him. The cries of the distressed parents soon bring together a number of interested spectators (for birds in such circumstances seem truly to sympathise with each other), and he is sometimes attacked with such spirit as to be under the necessity of making a speedy retreat."

Corvus Canadensis (the Canada jay) is by no means so showy a bird as the former. It is described as being "eleven inches long, and fifteen in the extent of the wings; back, wings, and tail, a dull leaden grey, the latter long, cuneiform, and tipped with dirty white; interior vanes of the wings brown, and also partly tipped with white; plumage of the head low and prominent; the forehead and feathers covering the nostrils, as well as the whole lower parts, a dirty brownish white, which also passes round the bottom of the neck like a collar; part of the crown, and hind head black; bill and legs, also black; eye dark hazel. The whole plumage on the back is long, loose, unwebbed, and in great abundance, as if to protect it from the rigours of the regions it inhabits.

"A gentleman of observation, who resided for many years near the North River, not far from Hudson, in the state of New York, informs me that he has particularly observed this bird to arrive there at the

commencement of cold weather; he has often remarked its solitary habits; it seemed to seek the most unfrequented shaded retreats, keeping almost constantly on the ground, yet would sometimes, towards the evening, mount to the top of a tree, and repeat its notes (which a little resemble those of the baltimore,) for a quarter of a hour together; and this it generally did immediately before snow or falling weather."

Corvus ossifragus (the fishing crow). This is another North American species, which is worthy of notice on account of the peculiarity of its habits. They are wholly aquatic birds; and are scavengers upon the numerous and productive waters of that part of the world, especially of those which are near the coast. They are birds of powerful wing for their size, and furnished with large and crooked claws. They hover along over the surface of the waters, and are ever and anon twitching down to seize in their claws any dead fish or other garbage that may be floating. They are most abundant in the southern part of the States, where the waters are more productive; they are understood to perch and nestle in high trees near the waters; and they are very common about fishing villages and fishing stations. It does not appear that they depend much on the land for their food, or in any way injure its cultivated produce. The following is the description:—they are sixteen inches in length, and thirty-three in the stretch of the wings; black all over, with reflections of steel blue and purple; the chin is bare of feathers around the base of the lower mandible. Upper mandible notched near the tip, the edges of each turned inwards about the middle; eye very small, placed near the corner of the mouth, and of a dark hazel colour; recumbent hair or bristles, large and long; ear feathers, prominent; first primary little more than half the length, fourth the longest; wings when shut reach within two inches of the tip of the tail; tail rounded and seven inches long from its insertion; thighs, very long; legs, stout; claws sharp, long and hooked, hind one the largest, all jet black. Male and female much alike.

Besides those which we have noticed there are many species or varieties in different parts of the world; but the manners of them all are very similar; and it is exceedingly probable the climatal varieties of those which are common with us, have been described as different species.

CORYPHÆNA Coryphene; the dolphin of the ancients. A genus of spinous-finned fishes, with abdominal fins, situated immediately under the pectorals, and thus referrible to the thoracic fishes of the Linnaean system; but included in the mackerel family (*Scomberoidæ*) in Cuvier's structural arrangement. They are numerous, and vary much in size, in colour, and in several other of their external appearances; but their generic characters are well made out, and there is a good deal of similarity in the habits of them all. The leading characters are:—The body compressed, elongated, and covered with very small scales, the head short, and truncated on the upper part; the gill-lids smooth, and with seven rays in the gill-flap; the dorsal fin beginning immediately behind the head, and ranging the whole length of the back, its rays of nearly the same flexibility throughout the whole length, but those of the anterior part have no articulation. All the members of this genus are pelagic fishes, enjoying free range of the wide sea, in the deep water rather than over the banks, remaining and

feeding near the surface. They are generally splendid in their appearance; and in point of colour, at least, they are among the most beautiful inhabitants of the deep. The brilliancy of their colours vanishes in death; so that it is impossible to form any idea of them from museum specimens, how carefully soever these may be prepared and preserved.

This holds, indeed, with regard to all the more splendid fishes; and, as the tints and lustres which they display, have a transparency about them, which does not belong to even the finest colours of land animals, so they have an evanescence, which renders it impossible to form any idea of them, unless when they are seen alive and in health. Those of this species, in particular, pass through a number of beautiful rainbow tints, while they are in the agonies of death; and this was one of the reasons why the luxurious Romans were so very fond of having coryphenes at their sumptuous entertainments; they did not, however, serve up these fishes, at least in the first instance, in the style in which fishes are served up at the tables of modern epicures. They brought them to table alive, so that the company might enjoy the luxury of seeing them die. After this they were withdrawn, cooked, and brought back again as an article of food.

Coryphenes are most abundant in the tropical seas, though some of them are found in the Mediterranean, but there are none in the polar seas, or, indeed, in very high latitudes, though it is probable that they extend farther into the southern hemisphere than the northern. They are remarkable for energy of life; and the radiant and finely varying tints which they display are living lustres, and add greatly to the beauty of the wide seas.

When they are coursing over the sea in shoals, which they generally do, though the shoal is never of wearisome extent, and the bright sun of the tropical sky is beating on them through a thin and continually varying stratum of water, and when they themselves are shooting along with the rapidity of flashes of lightning, they form an exhibition, than which there are few more beautiful in nature. Indeed, gorgeous as are many of the flowers in tropical countries, and gay as are many of the birds, their colours do not refract, and decompose, and reflect the light and return it in such an endless variety of tints, all liquid, as if they were molten in the element in which the creatures live, as is done by the fishes.

The sublimity of the wide sea, and the steady trade wind soon palls upon the sense; and, as there is little to be done on board ship in such places, and the heat is relaxing to Europeans, a passage there would be a very dreary matter, were it not for the sporting of the fishes, and of the long-winged birds, which rival the coryphenes in seeking their prey over the extensive ocean.

In such situations a shoal of coryphenes presents a rich treat to the spectator; nor is it by any means a passing glory, like a meteor in the sky, to be viewed only for a moment, and talked of afterwards as a thing of memory. They keep company with the ship for days, and even for weeks, ranging along for hundreds of miles; and, though the rate of sailing is considerable, it is in fine weather nothing at all to the speed of swimming in the coryphenes. They play round and round the ship, now shooting a-head, now getting astern, on the starboard at one time, and on the larboard at another. In every position of themselves and the light they are brilliant; but in no two posi-

tions of either one or the other are they exactly the same. At one time they are gold, at a second emerald, at a third sapphire, at a fourth amethyst; then they are carbuncle and ruby, and so on through every imaginable colour, named or unnamed; and in all they have that radiance which we have mentioned as, among living creatures, belonging only to the inhabitants of the deep. Nor are these uniform changes of the whole shoal; for as they do not all maintain the same posture, the same attitude, or the same depth in the water, the whole of this variety is given to the eye at once, so that it seems as if every varied beam into which the utmost radiance of a tropical sun can be divided were in continual play over them.

Then there is another part of the accompaniment which, though it has not all the innocence of this beautiful display of varied colours, is not without interest in its own way. These fishes cannot perform their rapid motions, so much exposed to the action of the sun, without considerable waste of their system; for it is a law of nature, that powerful action, of whatever kind it may be, requires support and renewal of substance in proportion to its energy. Hence the coryphenes are exceedingly voracious, and it is their voracity which makes them follow the ship with such persevering assiduity. Not, of course, that they expect to eat the ship; though they are not very particular as to the quality of what they swallow; but there is always some sort of fat thrown overboard, and this forms the chief attraction which ships have for those fishes that follow them.

It is singular how such an opinion of the acuteness of smell in fishes could have originated, as the parties have evidence of its falsehood constantly before their eyes. Every one knows that there is nothing peculiarly tempting to the olfactory nerves of a trout, in an artificial fly or an artificial minnow, and yet, when skilfully managed, these are as successful as real baits. The very fishes in question too, and indeed the whole mackerel family, seem to hesitate so short a time about smells, that a bit of scarlet rag, tin plate, bright shell or brass button, is taken by them just as readily as any other bait. Even in some of the soft-finned fishes which seem to have the olfactory nerves a little more developed, there appears to be an equal incapacity of distinguishing between what is food and what is not. When the workmen were occupied in erecting the light-house on the Bell-rock, they found the water over some parts of that rock so thick of whittings that they literally concealed the bottom for an extent of many yards; and they were as voracious as they were numerous, and as heedless as either; for the men had only to tie a crooked brass pin to the end of a bit of string, and so draw up whittings in any quantity they chose. But to return to the coryphenes.

All that these fishes can glean from the refuse thrown overboard from a ship would, of course, not support the millionth part of their number; and consequently they must be provided with other food, otherwise they could not exist in nature. One staple article with them is the flying fishes (see *EXOCETUS*), which they pursue with nearly the same assiduity as the porpoise pursues salmon, but with much greater success and more splendid effect; and, if any comparison could be instituted between land predatory animals and sea ones, one might say that the porpoise more resembles a bear on the pursuit, and the coryphene more a leopard; for the porpoise is ugly in its colour, and lumbering in its motions, while the coryphene is swift

and beautiful. In both cases the prey, when the case becomes one of extremity, attempts to escape by leaping out of the water; and, though the salmon falls instantly, and, generally speaking, into the mouth of its pursuer, while the flying-fish can keep in the air a little, as if it were supported on wings, yet its flight is short, and it not only increases the chance of being captured by the coryphene, but also subjects itself to as great danger from another enemy, the albatross or some other pelagic bird. Thus, it appears, that the flying-fish has rather an under share of piscine enjoyment. It is usually said that fishes, exempted from the burden of themselves in the air, and also from the vicissitudes of that element, have really nothing to do but enjoy one continual feast by eating one another; for which feast their amazing fertility affords a plentiful supply, in which all that man takes for his use is not missed.

It is not supposed that the flesh of any species of coryphene is poisonous; but, from the fleetness of their motions it is hard, dry, and tasteless, yet that of many of the species is eaten.

Cuvier divides the genus into several sub-genera, which we shall barely notice:—

CORYPHENES, properly so called. These have the body compressed, the head very much raised, the profile arched, the outline descending very rapidly to the muzzle, the eyes situated very low down, teeth on the palate as well as the jaws, and they are of larger size than the others. Their dorsal fin, which is very handsome, extends all the way from the nape to the tail; the caudal fin is forked in some, straight in others, and in others again rounded or pointed.

Coryphæne hippuris—common coryphene. This is the largest species of the whole, attaining the length of at least five feet. It occurs in the Mediterranean, and also in the oceans near the tropics. Its dorsal fin is long, with its edge nearly parallel to the line of the body, and the fork in the tail is deep. The back is bright sea-green, mottled with small orange spots; the belly is silvery; the lateral line yellow, the dorsal fin bright sky-blue, with gold coloured rays; the caudal fin greenish; and all the remaining fins yellow. This species is the dolphin of the ancient fables.

Three or more species have been enumerated by systematic writers, as belonging to the forked-tail subdivision of true coryphenes; but it is exceedingly difficult to determine what is a species, and what is not, in fishes which are so active and so highly coloured; and, as the difference between the one and the other does not appear to relate much either to structure or to manners, it is comparatively of little importance. The statement usually made is, that those species which occur to the south-eastward of Asia are brighter in colours, smaller in size, and even more rapid in their motions, than those which occur in the Mediterranean and the Atlantic; but their motions are so flat, and they are so seldom seen, that we cannot come to any positive conclusions respecting them. We may, however, just mention one or two of the most beautiful of this species.

Coryphæna aurata (the golden coryphene). This species is found in the Indian seas, is very rare, and has not been met with of so large a size as the coryphene of the Mediterranean. Its dorsal fin is shorter, and all blue without the gold-coloured rays. The tail is deeply forked, and all over of the colour of polished gold. The body consists of an endless variety of brilliant colours, which it is not possible to describe.

Coryphæna Boryi. This species is described as inhabiting the intertropical part of the Atlantic, and as differing in its shape from both the former, it being enlarged at the middle, so as to approach the form of the flat fishes. It has not been found more than two feet in length; and it is reported as affording more savoury food than the others.

It is described as being the most beautiful of all the fishes. The dorsal fin is high at the fore part, and gradually diminishes to the tail. It is of the most brilliant ultra-marine blue, marked with bright lines of rich indigo blue. The upper part of the head is a rich brown, passing through very fine tints of emerald green on the back into golden yellow on the sides and tail. The margin of the yellow is delicately marked with greyish; and the belly is silvery. All the fins, except the caudal and the dorsal are yellow. The caudal is deeply divided, or rather it consists of two separate fins attached to the extremity of the animal.

Coryphæna chrysurus—golden-tailed coryphene. This species is found in the south sea. Its body is very elongated. Its tail is of a remarkably brilliant gold colour, the back azure, the dorsal fin blue, spotted with yellow, the under part silvery, and all along the upper part marked with lenticular spots of deep blue, very numerous, and placed irregularly.

Coryphæna lutea—yellow coryphene. This species is described as being an inhabitant of the Indian seas, chiefly yellow on the upper part, and silvery on the under. Both this and the species immediately preceding, are described as being most assiduous in capturing the different species of flying fishes. The species with the tails straight or rounded, or lancet-shaped, have chiefly been observed in the eastern seas; and it is probable that they ought not to be included in this sub-genus, and some of them not in this genus at all.

CENTROLOPUS. This division of the genus have two spinous prominences in front of the dorsal fin, but the spines are so short that they can be felt only by pressing the finger pretty strongly against the skin. Their bodies are compressed, their scales small, their head longer than that of the true coryphenes, but obtuse at the muzzle. One species of this division has acquired some celebrity, at least it possessed some in ancient times on account of its attendance upon vessels. This is,

Coryphæna pompilus, so called as it forms part of the cortege or train of the ship. It is about a foot in length, diminishing in thickness towards the tail, feels greasy to the touch; its back is marked with yellow bands, and there are golden yellow stripes above the eyes resembling eyebrows. This species is found both in the Mediterranean and the Atlantic.

LEPTOPODES. This division, like the former, has dorsal prominences barely discoverable by the finger; but it differs in having the dorsal and anal fins running into each other, so as to form a pointed tail.—There is only one known species (*Leptopodes Ater*), which is a little fish, feeble, and timid. It is found in the Mediterranean, in the deep water, during the greater part of the year, but approaches the shore about the month of August for the purpose of spawning. It is about six inches in length; the general colour is deep black, with violet reflections. Its muzzle is rounded, its eyes small, with golden irides. In the spawning season it might be taken in any quantity, but its flesh is soft and insipid, and good for nothing.

There are many important particulars to be learned from the careful study of those pelagic fishes which range far and wide over the sea; and no species of them are calculated to afford us more information in this respect than the mackerel family; because they live more exposed than almost any other fishes, and, therefore, they serve better as indexes to the general economy of nature in the sea. But in proportion as their manners and the influence of varying seasons upon them are important, they are difficult to be studied; because the sea is a wide surface, of which man can see but a small part at once, and we do not meet with the same inhabitants, or even the same water, when we twice visit the same spot.

COSSUS. A genus of lepidopterous insects, belonging to the family *HEPIATIDÆ*, which see.

COTINGA—Ampelis. A genus of American birds, belonging to the fly-catching tribe of the denti-rostral division of Cuvier's great order *Passeres*, and ranged between the fly-catchers properly so called and the bee-eaters. These birds were ranged by the elder ornithologists, along with many others, in a very extensive genus, but they have been since subdivided. The cotingas, properly so called, all inhabit the rich and humid forests of America. They are conspicuous for the rich colours of their plumage, in which purple and blue are the prevailing tints.

The characters are: the bill of mean length, a little depressed, higher than wide, three cornered at its base, flattened at its point, moderately hard; upper mandible convex, with a ridge on the culmen, and notched towards the point, which is curved; the inferior mandible a little flattened on the under side; nostrils at the sides of the base, round, half closed with membrane and by some silky feathers; feet of mean size, three toes to the front, one behind; the two outside, in front, united to the second; and the hind toe the same length as the outer one; wings rather short, the first quill shorter than the second, which is the longest in the wing.

As restricted by Cuvier, the genus *Cotinga* is a very peculiar one, and does not contain a very great number of species. The birds which compose it are all of a wild and retiring character, shy and silent, having nothing in their conduct or their sounds at all corresponding to the brightness of their covering. They are found only at those parts of America which have a strictly tropical climate, and even in these, they are confined to moist and shady situations which abound with insects, though they are also understood to live, in part, upon soft and sugary fruits. They are not, however, so destructive to plantations as many other birds that have the same mode of feeding; but though they are retiring, and also confined within geographical limits, they are not absolutely stationary; yet, the only object of their little voyage is, to arrive in certain places at the epoch in which the fruits they subsist on are mature. In Guiana, the spots in which they most delight, in those seasons when they are seen near habitations, are humid places. It is an error to suppose that they are destructive to the rice grounds. From the peculiar conformation and absence of solidity in their bill, it is impossible that they can be granivorous birds. According to Sonnini, the inhabitants do not eat their flesh, and if the stuffed specimens often arrive in Europe in a bad state, this is not the reason; it is rather, because the feathers not being very adherent, the tender skin requires a degree of care in its preparation, which is not always

bestowed upon it in America. The size of the cotinga varies from that of the raven to that of the song thrush. The colours of the females are, in general, much less rich than those of the males; their plumage is, indeed, frequently dull and dusky. The habits of these birds, and the facts concerning their reproduction, are very imperfectly known; many species, however, are known to make their nests on the loftiest trees, and lay four or five eggs.

As the same parts of the forests in which these birds nestle, are inhabited by climbing quadrupeds, which are much disposed to plunder both eggs and young, the birds take the precaution of building at heights, and under circumstances of concealment, which make their broods pretty safe, not only from quadruped enemies, but from nest-plundering birds, of which there are many species in the luxurious forests of tropical America. Thus, the cotingas, in their quiet way, contrive to get on as well in their domestic economy as the most noisy tenants of the forest. Their general history is a short one: they live in the very richest places of the world, feed well, wear handsome clothing, dwell in secure habitations, and take as little fatigue as they possibly can. We shall just mention one or two of the species.

Blue Cotinga.—Plumage bright azure, with the exception of the head, neck, and breast, which are rich purple; the quills and coverts, and also the bill and feet, are black. These are the colours of the male bird; and the length is about eight inches and a half. The female is of a blackish brown with purple reflections on the under part, and each feather slightly bordered with white. Head and under tail-covert red. The young, while in their nest, in plumage resemble the female. This species is found in Guiana.

Brazil Cotinga or *Blue Riband*.—This is a very beautiful species, rather smaller than the former. Its upper part is exceedingly bright azure blue; the under part rich violet purple, with a band of black crossing the breast, the quills, and the coverts. The bill and feet are black. The young have the under part marked with small flame-coloured spots.

There are three or four species more, which appear to be tolerably well defined and established, and there are some others which are doubtful; but, as we have already said, there is not much of interest in the manners of the birds, nor would there be more to the general reader in merely running over changes or markings of colour, however beautiful.

COTTON, is the name of the plant, as well as of the filaceous substance produced by the *Gossypium*, *Herbaceum*, *Vitifolium*, &c., of botanists. Linnæan class and order, *Monadelphica Polyandria*, and natural order, *Malvaceæ*. Generic character: involucre large, three-lobed, persisting, segments heart-shaped; calyx goblet-shaped, five-toothed; petals inversely heart-shaped; stamens united in a cylinder; anthers kidney-shaped; style columnar; stigmas three or five; seed-vessel three-celled and three-valved; seeds enveloped in wool. It is almost unnecessary to observe, that this is one of the most useful plants known, and not only to the warmer parts of Asia, where it is cultivated, but to every other part of the civilised world, whether favourable to its culture or not. As an article of commerce and manufacture, it rivals the fleeces of the northern latitudes, and perhaps employs as much, or more capital, than any other branch of trade whatever. For further particulars, see MALVACEÆ.

COTTUS (Bull-head). A genus of spinous-finned fishes, belonging to Cuvier's division of *Joues cuirassées*, or fishes with hard plates on the cheeks, and which he ranks immediately after the perch family. The relations of the family will be pointed out shortly in the article HARD CHEEKS, and more at length in the general article FISH, so that we shall only, in this article, have to notice the generic characters, adding some short notice of the species, particularly of such as are British.

The most general description which can be given of this genus of fish is,—that they are all very small and very ugly, and, at the same time, of little or no use to man; but, from their very general distribution, they must answer some important purpose in the economy of nature, and there is little doubt that they are also of much indirect importance to the human race, in affording food to larger and more valuable fishes.

The generic characters are: the head large and depressed, furnished with hard plates on the cheeks, which are variously armed with spines and tubercles; two dorsal fins; teeth in the advanced part of the vomer, but none in the palatal bones; six rays in the gills, and three or four only in the ventral fins. They have no air bladder.

The head is disproportionately large, flattened, and has the eyes turned upward, which gives them an unhandsome appearance; their colours also are very dull, and their skin is, in general, covered with a mucous secretion, so that they slide through the fingers of those who offer to catch them. They are found both in the fresh waters and in the sea, but the greater number are inhabitants of the fresh waters, and these have the head always smooth and only one spine on the gill-lid. They are, though small, lively and active fishes, lurking under stones and in small holes of the banks and bottoms, from which they issue with great rapidity, and seize fry-worms, the larvæ of aquatic insects; but as some of them inhabit fresh water and others salt, and as the ones that have these different haunts have also necessarily different manners, it will be desirable to treat each species by itself. Of the enumerated species, at least five are natives of Britain; and as, though they are not of much value in an economical point of view, they are of some curiosity as subjects of natural history, we shall give some notice of each of them.

Cottus gobio, the river bull-head, miller's thumb, tommy logge, and various other names. This species seldom exceeds four inches or four and a half in length; its head, though flattened, is broad, but its body is very slender. It is pretty generally distributed over Europe, being found in most of the small streams of fresh water from Italy to Russia; but it is found only in gravelly places, or, at least, where the water is not impregnated with peat, and, for this reason, it is not general in Scotland or in Ireland, except in the north-east part of the country, where there are no peat bogs. Its flattened head and hard cheeks enable it to poke itself under stones; and thus, as its motions are very quick, it is not seen without some difficulty. Those who are curious in tracing the origin of popular names, suppose it is called the bull-head in consequence of the size of its head, though it probably receives this appellation as much from its wrinkled front. "The miller's thumb" has given rise to various other speculations. Some have said that the thumb of a miller derives a particular shape, resembling that of the head of this fish,

from his thumbing the meal to try if it is properly ground. But it is probable that the mere fact of the fish being found pretty generally in mill-streams may have given origin to the name; for the head of the fish is more like the thumb of a cobbler than that of a miller. As this species is greasy to the feel and insipid to the taste, and as it contains little flesh, good or bad, it is not eaten in this country; but it is said to be eaten in Italy; and that, in some parts of the north of Europe, it is hung up, exactly balanced, in order that by the direction of its head it may tell how the wind sets, which, of course, it does not do unless exposed to the wind.

The particular characters of this species are: the mouth wide, the jaws of nearly equal length, with numerous pointed teeth in both jaws, and also on the anterior part of the vomer; the head spinous; pupils of the eyes dark blue, irides yellow; gills ending in a flattened point; a membrane between the two dorsal fins; rays of all the fins spotted; upper part blackish brown; sides lighter, spotted with black, under part white. This species deposits its spawn in summer.

Cottus bubalis (father-lasher, long spined-cottus). This is a very formidable looking fish, and from its shape, its numerous spines, and a variety of other peculiarities in its appearance, it is a fish of some interest. It belongs to the cold seas rather than to the warm; and though it is rarely met with on the British shores of more than from six to nine inches in length, it grows much larger in the extreme north, and the natives of Greenland are said to make a sort of soup of it, similar to that which is made of the haddock in Scotland. In ordinary cases the father-lasher expires the moment it is taken out of salt water and put into fresh, but by gradually passing through the brackish water it is said to be able to ascend the estuaries for the purpose of depositing its spawn, which it does about the month of January. It is by no means uncommon on the British shores, and is frequently left, at low water, in small pools among the rocks, and when it is attempted to be caught by the hand it puts on rather a formidable appearance, by distending its gill-covers, erecting the spines, and making motions as if it were disposed to strike right and left at any one who might attempt to seize it.

We know not what may be the cause, but there are many parts of the east coast of Scotland where this fish is more frequently found dead on the beach than any other species; and as we have generally met with its body upon gravelly beaches where the current runs strong, it may be that it gets entangled among the stones and stranded, or that the want of an air-bladder may prevent it from managing itself well in turbulent water.

Notwithstanding the frequency of the dead body of this fish on the places of the coast that have been alluded to, it is by no means a delicate fish, but on the other hand remarkably tenacious of life. It is well observed by Mr. Yarrell, in his work on British fishes, now in course of publication, that the largeness of the gill-openings of fishes, cannot be the only cause why they die soon when taken out of the water. All fishes which have the gill-lid armed with erectible spines, have more power over it than those which possess no such armature; and we may naturally conclude, that they are able to move these with less derangement to the fibres of the gills when these are not supported in water.

The head of the father-lasher has some resemblance to that of a lurking predatory quadruped, with its ears laid backwards against its neck, and prowling for prey. The eyes are very near to each other, and the sight directed vertically, their colour, black pupils with yellow irides, gives them a little the air of those of a wild beast; and this is further heightened by the elevation and straightness of the frontal ridges. These ridges are continued quite to the nape, where they end in two spines; there are also four spines upon the pre-operculum, of which the upper one is of considerable length; one on the scapula, and a clavicular one on each side, and two on the nose. The colour on the upper part is dark brown, mottled with red brown, the under part is white. There has been some confusion between this and another marine species, although in appearance there is a good deal of difference between them. This other species is—

Cottus scorpius (the sea scorpion, or short-spined cottus). This is also an inhabitant of seas far to the north, and understood to grow to a larger size in cold latitudes than in those which are more temperate; and though it is not very likely, still it is possible that it may seek the more southerly haunts for the purpose of spawning. With us it is about the same size as the other, and it is found abundantly in many parts of the shore. In its general appearance it holds a sort of middle place between the river bull-head and the father-lasher. The head is large, more elevated than that of the bull-head, with a prominent ridge between the eyes and the snout, and a spine on each side of it. There are no spines on the nape, but there are three short ones on the pre-operculum, and two on the operculum itself. The colour is nearly the same as that of the former species, but the shape of the fins is different, and the ventral fins are attached, posteriorly, to the belly of the fish by a membrane. It is understood that this species spawns much later in the year than the father-lasher, which latter species spawns in January.

Cottus quadricornus. This is also a northern species, being much more frequent on the northern shores of Europe than in the temperate countries, though it is by no means rare on some parts of the east coast of Britain; and it is understood that this is about the last fish that is met with in the extreme north. There are four horned tubercles on the upper part of the head, from which it gets the name of four horned. It has three spines on the pre-operculum, and one only on the operculum. The body of it is more elongated than that of the other species; the head is brown, with some red on the gill-covers, the sides yellowish, and the belly white; the fins are finely clouded and mottled. It grows to be a little larger than any of the others, at least it grows longer; but it is seldom used unless as a bait for other fish.

This species comes much more rarely on the British shores, so as to be taken in the pools at low water, than any of the former; but it is not unfrequently met with by the fishers for sprats.

All the marine species of this genus are understood to be voracious, and to feed chiefly upon the fry of other fish, and upon small crustaceous animals, which last they catch in great numbers among the sea weed. They cannot be considered as giving any very striking character to the places which they inhabit, inasmuch as they are but of diminutive size, do not crowd in numerous shoals, and are of little value. They have, however, a distinct geographical

locality, and therefore, they must, in so far, form an index to the general economy of nature in that locality, if we could but once become acquainted with their manners.

The allied tribes which used to be included in the same genus, but are now separated from it, differ in some of their characters; but it may not be amiss here to mention one of them which is still popularly, at least, considered as a bull-head. This is,

Aspedorus Europæus, the armed bull-head or pogge, the characters of which are: the body eight cornered, covered with scaly plates, and tapering toward the tail. The head thicker than the body; snout with red coloured spines, and teeth in both jaws, but none on the vomer. Two distinct dorsal fins, but smaller than those of the former species. This is a northerly fish also; but in summer it is found in most of the sandy bays, near the mouths of rivers on the east coasts of Britain: it is small, not above six inches in length, but its flesh is described as being firmer and better than that of the true cotta.

COW-BUNTING, or CATTLE-BIRD (*Molothrus pecoris*, Swainson). "There is one striking peculiarity in the works of the great Creator," observes Wilson, the historian of the birds of the United States, "which becomes more amazing the more we reflect on it, namely, that he has formed no species of animals so minute, or obscure, that are not invested with certain powers and peculiarities, both of outward conformation and internal faculties, exactly suited to their pursuits, sufficient to distinguish them from all others; and forming for them a character, solely and exclusively their own. This is particularly so among the feathered race. If there be any case where these characteristic features are not evident, it is owing to our want of observation; to our little intercourse with that particular tribe; or to that contempt for inferior animals, and all their habitudes, which is but too general, and which bespeaks a morose, unfeeling, and unreflecting mind. These peculiarities are often surprising, always instructive when understood, and, (as in the subject of the present article,) at least amusing, and worthy of being farther investigated."

"The American cattle-bird, the subject of the present memoir, is a small bird, about the size of the European sky-lark, and belongs to the natural family *Sturnidæ*, or starling tribe; forming one of the many connecting links between that family and the *Fringillidæ*, or finches. It is closely allied to the troopials (*Agelaius*), or the genus to which the common red-winged black-bird (as it is locally called) of North America belongs; but is even more finch-like, or rather bunting-like, in its form, and so very peculiar and remarkable in its habits and history, that it cannot exactly be classed in the same division with any other known species. The form of the bill is very nearly that of the true bunting (*Emberiza*), but straighter, and more starling-like in its outline; and the general shape of the body is about the same as that of the troopials, only rather more finch-like; its length is about seven inches, and extent of the wings eleven inches. The head and neck are of a very deep silky drab, and the upper part of the breast a dark changeable violet; the rest of the bird black, with a considerable gloss of green when exposed to a good light. Tail, slightly forked; legs and claws glossy black, strong and muscular; iris of the eye dark hazel. The female is, all over, of a brown colour, somewhat paler underneath, and the young male birds are, at first, altogether brown, and,

for a month or more, are naked of feathers round the eye and mouth; the breast is also spotted like that of a thrush, with light drab and darker streaks. In about two months after they leave the nest, the black commences at the shoulders of the wings, and gradually increases along each side as the young feathers come out, until the bird appears mottled on the back and breast with deep black and light drab. At three months the colours of the plumage are complete, and, except in moulting, are subject to no periodical change. The sexes also are alike in size, and do not exhibit, in this respect, the remarkable disparity which is observed in all the troopials.

"The most remarkable trait in the character of this species is, the unaccountable practice it has of dropping its eggs into the nests of other birds, instead of building and hatching for itself, and thus entirely abandoning its progeny to the care of strangers. More than two thousand years ago, it was well known, in those countries where the bird inhabits, that the cuckoo of Europe (*Cuculus canorus*)"—See Cuckoo—"never built herself a nest, but dropt her eggs in the nests of other birds; but, among the thousands of different species that spread over that and other parts of the globe, no other instance of the same uniform habit has been found to exist," (save, however, in one or two other species of *Cuculus*;) "until discovered in the bird now before us. Of the reality of the former there is no doubt; it is known to every school-boy in Britain; of the truth of the latter I can, myself, speak with confidence, from personal observation, and from the testimony of gentlemen, unknown to each other, and residing in different and distant parts of the United States."

These are the words of Wilson; and, as those of an original observer are always far better than any abstract that can be made of them, we will here copy his description of the habits of this singular species at some length, intending also to give a rather detailed account of those of the European cuckoo; the peculiarities of the one being found to throw not a little light upon those of the other. "The circumstances," he continues, "by which I became first acquainted with this peculiar habit of the bird are as follow:—

"I had, in numerous instances, found, in the nests of three or four particular species of birds, one egg much larger, and differently marked from those beside it; I had remarked, that these odd-looking eggs were all of the same colour, and marked nearly in the same manner, in whatever nest they lay, though frequently the eggs beside them were of a quite different tint; and I had also been told, in a vague way, that the cow-bird laid in other birds' nests. At length I detected the female of this very bird in the nest of the red-eyed fly-catcher, which nest is very small, and very singularly constructed;" (a neat pensile nest, hung by the two upper edges, and very firm and durable). "Suspecting her purpose, I cautiously withdrew without disturbing her, and had the satisfaction to find, on my return, that the egg which she had just dropt, corresponded as nearly as eggs of the same species usually do, in its size, tint, and markings, to those formerly taken notice of. Since that time, I have found the young cow-bunting, in many instances, in the nests of one or other of these small birds. I have seen these last followed by the young cow-bird, calling out clamorously for food, and often engaged in feeding it; and I have now, in a cage before me, a very fine one, which, six months

ago, I took from the nest of the Maryland yellow throat, &c. * * * I claim, however, no merit for a discovery not originally my own; these singular habits having long been known to people of observation resident in the country, whose information, in this case, has preceded that of all our school philosophers and closet naturalists, to whom the matter has, till now, been totally unknown.

"About the twenty-fifth of March, or early in April, the cow-pen bird makes its first appearance in Pennsylvania from the South, sometimes in company with the red-winged blackbird," (or troopial, *Aglaius phœniceus*), "more frequently in detached parties, resting, early in the morning, an hour at a time, on the tops of trees near streams of water, appearing solitary, silent, and fatigued. They continue to be occasionally seen, in small solitary parties, particularly along creeks and banks of rivers, so late as the middle of June; after which we see no more of them until about the beginning or middle of October, when they re-appear in much larger flocks, generally accompanied by numbers of the red-wings" (troopials); "between whom and the present species there is a considerable similarity of manners, dialect, and personal resemblance. In these aerial voyages, like other experienced navigators, they take advantage of the direction of the wind, and always set out with a favourable gale.

* * * * *

"From the early period at which these birds pass in the spring, it is highly probable that their migrations extend very far north. Those which pass in the months of March and April, can have no opportunity of depositing their eggs here," (in the United States,) "there being not more than one or two of our small birds which build so early. Those that pass in May and June are frequently observed loitering about solitary thickets, reconnoitering, no doubt, for proper nurses, to whose care they may commit the hatching of their eggs and the care of their helpless orphans. Among the birds selected for this duty are the following. * * *

The bluebird" (*Sialia Wilsonii*), "which builds in a hollow tree; the chipping sparrow" (*Emberizoides socialis*), "in a cedar bush; the golden-crowned thrush-pipit" (*Sciurus auricapillus*), "on the ground, in the shape of an oven; the red-eyed fly-catcher" (*Vireo olivaceus*), "a neat pensile nest, hung by the two upper edges on a small sapling or drooping branch; the yellow-bird" (or American gold-finch, *Carduelis luteus*), "in the fork of an elder; the Maryland yellow-throat" (*Trichas personatus*, a little bird somewhat allied to the European hedge chanter), "on the ground, at the roots of brier bushes; the white-eyed fly-catcher" (*Vireo noveboracensis*), "a pensile nest, on the bending of a vine; and the small blue-grey fly-catcher" (*Culicivora cœrulea*), "also a pensile nest, fastened to the slender twigs of a tree, sometimes at the height of fifty or sixty feet from the ground. There are, no doubt, others to whom the same charge is committed; but all these I have myself met with acting in that capacity.

"Among these, the yellow-throat and the red-eyed fly-catcher appear to be particular favourites, and the kindness and affectionate attention which these two little birds seem to pay to their nurslings, fully justify the partiality of the parents.

"It is well known to those who have paid attention to the manners of birds, that, after their nest is fully

finished, a day or two generally elapses before the female begins to lay. This delay is, in most cases, necessary to give firmness to the yet damp materials, and allow them time to dry. In this state it is sometimes met with, and laid in by the cow-bunting; the result of which, I have invariably found, to be the desertion of the nest by its rightful owner, and the consequent loss of the egg thus dropt in it by the intruder. But when the owner herself has begun to lay, and there are one or two more eggs in the nest before the cow-bunting deposits hers, the attachment of the proprietor is secured, and remains unshaken until incubation is fully performed, and the little stranger is able to provide for itself." There is a little here at variance with the habit of the cuckoo of Europe, which is, always to destroy whatever other eggs there may be in a nest into which she introduces her own; any eggs, therefore, which are ever found together with that of the cuckoo, have usually not been laid till after its deposition; never, in fact, but in cases where the cuckoo had been disturbed, as she sometimes is by the proper owners of the nest, before she had had time to finish her operations; an instance of which was once observed by the writer of this.—See Cuckoo.

"The well known practice of the young cuckoo of Europe," continues Wilson, "in turning out all the eggs" (?) "and young which it feels around it, almost as soon as it is hatched, has been detailed in a very satisfactory and amusing manner by the amiable Dr. Jenner*, who has since risen to immortal celebrity in a much nobler pursuit, and to whose genius and humanity the whole human race are under everlasting obligations. In our cow-bunting, though no such habit has been observed, yet still there is something mysterious in the disappearance of the nurse's own eggs soon after the foundling is hatched, which happens regularly *before* all the rest. From twelve to fourteen days is the usual time of incubation of our small birds; but although I cannot exactly fix the precise period requisite for the egg of the cow-bunting, I think I can say almost positively, that it is a day or two less than the *shortest* of the above-mentioned species! In this singular circumstance we see a striking provision of the Deity; for, did this egg require a day or two more, instead of so much less, than those *smaller* eggs among which it has been dropped, the young it contained would, in every instance, most inevitably perish; and thus, in a few years, the whole species must become extinct. On the first appearance of the young cow-bunting, the parent being frequently obliged to leave the nest to provide sustenance for the foundling, the business of incubation is thus necessarily interrupted; the disposition to continue it abates; nature has now given a new direction to the zeal of the parent, and the remaining eggs, within a day or two at most, generally disappear. In some instances, indeed, they have been found on the ground near, or below, the nest; but this is rarely the case.

"I have never known more than one egg of the cow-bunting dropped into the same nest. This egg is somewhat larger than that of the blue-bird" (that is to say, about the size of that of the yellow-bunting of Europe), "thickly sprinkled with grains of pale brown on a dirty white ground—it is of a size propor-

* See Philosophical Transactions for 1788. Part ii.

tionable to that of the bird"—the European cuckoo's is not.

"So extraordinary and unaccountable is this habit, that I have sometimes thought it might not be general among the whole of this species in every situation, that the extreme heat of our summers, though suitable enough for their young, might be too much for the comfortable residence of their parents; that, therefore, in their way to the north, through our climate, they were induced to secure suitable places for their progeny; and that, in the regions where they more generally pass the summer, they might, perhaps, build nests for themselves, and rear their own young, like every other species around them. On the other hand, when I consider that many of them tarry here so late as the middle of June, dropping their eggs, from time to time, into every convenient receptacle; that in the States of Virginia, Maryland, Delaware, New Jersey, and Pennsylvania, they uniformly retain the same habits; and, in short, that in all these places I have never yet seen or heard of their nests,—reasoning from these facts, I think I may safely conclude, that they never build one; and that in those remote northern regions their manners are the same as we find them here.

"What reason nature may have for this extraordinary deviation from the general practice, is, I confess, altogether beyond my comprehension. There is nothing singular to be observed in the anatomical structure of the bird that would seem to prevent or render it incapable of incubation" (nor is there in that of the European cuckoo). "The extreme heat of our climate is probably one reason why, in the months of July and August, they are rarely to be seen here; yet we have many other migratory birds that regularly pass through Pennsylvania to the north, leaving a few residents behind them, which, without exception, build their own nests and rear their own young. This part of the country also abounds with suitable food, such as they usually subsist on. Many conjectures, indeed, might be formed as to the probable cause, but all of them that have occurred to me are unsatisfactory and inconsistent. Future and more numerous observations, made with care, particularly in those countries where they most usually pass the summer, may throw more light on this matter, till then, we can only rest satisfied with the reality of the fact.

"This species winters regularly in the lower parts of North and South Carolina and Georgia; I have also met with them near Williamsburgh, and in several other parts of Virginia. In January, 1809, I observed strings of them for sale in the market of Charlestown, South Carolina. They often frequent corn and rice fields, in company with the red-winged troopials, but are more commonly found accompanying the cattle, feeding on the seeds, worms, &c., which they pick up amongst the fodder and from the excrements of the cattle which they scratch up for this purpose"; which, be it remarked, is often the habit of the European starling (*Sturnus vulgaris*). "Hence they have pretty generally obtained the name of *Cow-pen-birds*, *Cow-birds*, or *Cow-blackbirds*. By the naturalists of Europe they have hitherto been classed with the finches, though improperly, as they have no family resemblance to that tribe sufficient to justify that arrangement," &c.

"Respecting this extraordinary bird," says Wilson, "I have received communications from various

quarters, all corroborative of the foregoing particulars. Among these is a letter from Dr. Potter of Baltimore, which, as it contains some new and interesting facts, and several amusing incidents, I shall, with pleasure, lay before the reader, apologising to the obliging writer for a few unimportant omissions which have been anticipated in the preceding pages." The limits, however, of this Cyclopædia will not allow us to transcribe the whole of this highly interesting communication; we will select only a few of the more important facts, but we heartily recommend the reader to peruse the original, the details of which evince a habit of patient investigation, and a degree of philosophic caution, which naturalists in general would do well to imitate.

"The cow-pen finch differs, moreover," says the writer, "in another respect, from all the birds with which I am acquainted. After an observance of many years, I could never discover anything like *pairing* or a mutual attachment between the sexes. Even in the season of love, when other birds are separated into pairs, and occupied in the endearing office of providing a receptacle for their offspring, these birds are seen feeding in odd as well as even numbers, from one to twenty, and discovering no more disposition towards perpetuating their species than birds of any other species at other seasons, excepting a promiscuous concubinage which pervades the whole tribe." The same obtains in the European cuckoo. "When the female separates from the company, her departure is not noticed; no gallant partner accompanies her, nor manifests any solicitude in her absence; nor is her return greeted with that congratulatory tenderness that so eminently characterises the males of other birds. The male proffers the same civilities to any female indiscriminately, and they are reciprocated accordingly, without exciting either resentment or jealousy in any of the party. This want of sexual attachment is not inconsistent with the general economy of this singular bird; for, as they are neither their own architects nor nurse of their own young, the degree of attachment that governs others would be superfluous. * * *

"By a minute attention to a number of these birds when they feed in a particular field in the laying season, the deportment of the female, when the time of laying draws near, becomes particularly interesting. She deserts her associates, assumes a drooping, sickly aspect, and perches upon some eminence where she can reconnoitre the operations of other birds in the process of nidification. If a discovery suitable to her purpose cannot be made from her stand, she becomes more restless, and is seen flitting from tree to tree, till a place of deposit can be found. I once had an opportunity of witnessing a scene of this sort, which I cannot forbear to relate:—Seeing a female prying into a bunch of bushes in search of a nest, I determined to see the result, if practicable; and knowing how easily they are disconcerted by the near approach of man, I mounted my horse and proceeded slowly, sometimes seeing and sometimes losing sight of her, till I had travelled nearly two miles along the margin of a creek. She entered every thick place, prying with the utmost scrutiny into places where the small birds usually build, and at last darted suddenly into a thick copse of alders and briers, where she remained five or six minutes, when she returned, soaring above the underwood, to the company she had left feeding in the field. Upon entering the covert, I found the

nest of a yellow-throat" (*Trichas personatus*), "with an egg of each. * * * In the progress of the cow-bird along the creek's side, she entered the thick boughs of a small cedar, and returned several times before she could prevail on herself to quit the place; and upon examination, I found a" species of "sparrow sitting on its nest, into which she no doubt would have stolen in the absence of its owner." We may have occasion to refer to these observations when we give the natural history of the European cuckoo.

"The deportment of the yellow-throat on this occasion is not to be omitted. She returned while I waited near the spot, and darted into her nest, but returned immediately and perched upon a bough near the place, remained a minute or two and entered it again, returned and disappeared. In ten minutes she returned with the male. They chattered with great agitation for half an hour, seeming to participate in the affront, and then left the place. I believe all the birds thus intruded upon, manifest more or less concern at finding the egg of a stranger in their own nests. Among these, the sparrow* is particularly punctilious, for she sometimes chirps her complaints for a day or two, and often deserts the premises altogether, even after she has deposited one or more eggs." Many small birds will indeed eject an alien egg from the nest. "The following anecdote will show, not only that the cowpen finch insinuates herself slyly into the nests of other birds, but that even the most pacific of them will resent the insult. A blue-robin had built for three successive seasons in the cavity of a mulberry tree near my dwelling. One day, when the nest was nearly finished, I discovered a female cow-bird perched upon a fence stake near it, with her eyes apparently fixed upon the spot, while the builder was busy in adjusting her nest. The moment she left it, the intruder darted into it, and in five minutes returned and sailed off to her companions with seeming delight, which she expressed by her gestures and notes. The blue-bird soon returned and entered the nest, but instantaneously fluttered back with much apparent hesitation, and perched upon the highest branch of the tree, uttering a rapidly repeated note of complaint and resentment, which soon brought the male, who reciprocated her feelings by every demonstration of the most vindictive resentment. They entered the nest together, and returned several times uttering their uninterrupted complaints for ten or fifteen minutes. The male then darted away to the neighbouring trees, as if in quest of the offender, and fell upon a cat-bird," (*Orpheus felivox*), "which he chastised severely, and then turned to an innocent sparrow that was chanting its ditty in a peach tree. Notwithstanding the insult was so passionately resented, I found the blue-bird had laid an egg the next day. Perhaps a tenant less attached to a favourite spot would have acted more fastidiously, by deserting the premises altogether." We know, indeed, from direct experiments, that when the egg of a stranger is placed into a nest before any of the owner's eggs had been deposited, the nest is most usually forsaken.

Some interesting observations follow, upon the nature and disposition of the various birds into whose nests the cow-bird's egg is commonly deposited, with some remarks on the curious fact, that the eggs of the owner of the nest are never hatched, as those always are which accompany the cuckoo's egg. We need

not here transcribe all the detail of facts that is given, but will come at once to the writer's conclusion. "How do the eggs get out of the nest? Is it by the size and nestling of the young cow-bird? This cannot always be the case; because, in the instance of the blue-bird's nest in the hollow stump, the cavity was a foot deep, the nest at the bottom, and the ascent perpendicular; nevertheless the eggs were removed, although filled with young ones; moreover a young cowpen finch is as helpless as any other young bird, and, so far from having the power of ejecting others from the nest, or even the eggs, that they are sometimes found on the ground under the nest, especially where the nest happens to be very small. I will not assert that the eggs of the builder of the nest are never hatched; but I can assert, that I have never been able to find one instance to prove the affirmative. If all the eggs of both birds were to be hatched, in some cases the nest would not hold half of them; for instance, those of the sparrow, or yellow-bird. I will not assert that the supposititious egg is brought to perfection in less time than those of the bird to which the nest belongs; but, from the facts stated, I am inclined to adopt such an opinion. How are the eggs removed after the accouchement of the spurious occupant? By the proprietor of the nest unquestionably; for this is consistent with the rest of her economy. After the power of hatching then is taken away by her attention to the young stranger, the eggs would be only an incumbrance, and therefore instinct prompts her to remove them. I might add, that I have sometimes found the egg of the sparrow, in which were unmatured young ones, lying near the nest containing a cow-bird, and therefore I cannot resist this conclusion. Would the foster parent feed two species of young at the same time? I believe not. I have never seen an instance of any bird feeding the young of another, unless immediately after losing her own. I should think the sooty looking stranger would scarcely interest a mother, while the cries of her own offspring, always intelligible, were to be heard. Should such a competition ever take place, I judge the stranger would be the sufferer, and probably the species soon become extinct. Why the *lex naturæ conservatrix* should decide in favour of the surreptitious progeny is not for me to determine."

It will be seen upon a reference to our article Cuckoo, that the ingenious writer was wrong in some of these suppositions. We need not, however, here forestall our account of the various facts which we have to give concerning that interesting bird; but proceed now to copy Wilson's description of a cow-bunting, which he reared in confinement, and must then conclude our long account of this very singular species. "In the month of July, I took from the nest of the Maryland yellow-throat, which was built among the dry leaves at the root of a brier bush, a young male cow-bunting, which filled and occupied the whole nest. I had previously watched the motions of the foster parents for more than an hour, in order to ascertain whether any more of their young were lurking about, or not; and was fully satisfied that there were none. They had, in all probability, perished in the manner before mentioned. I took this bird home with me, and placed it in the same cage with a Red-bird," (or Cardinal grosbeak, *Guarica cardinalis*), "who, at first, and for several minutes after, examined it closely, and seemingly with great curiosity. It soon became cla-

* A very different bird from the sparrow of northern Europe.
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morous for food, and from that moment the red-bird seemed to adopt it as his own, feeding it with all the assiduity and tenderness of the most affectionate nurse. When he found that the grasshopper which he had brought it was too large for it to swallow, he took the insect from it, broke it in small portions, chewed them a little to soften them, and with all the gentleness and delicacy imaginable, put them separately into its mouth. He often spent several minutes in looking at it, and examining it all over, and in picking off any particles of dirt that he observed on its plumage. In teaching and encouraging it to learn to eat of itself, he often reminded me of the lines of Goldsmith—

“ ‘He tried each art, reprov'd each dull delay,
Allur'd to 'fav'rite food,' and led the way.’ ”

The sight, however, of a young helpless nestling operates wonderfully upon the instinctive feelings of most birds, however dissimilar may be the species, of which a very striking instance has been already given in our article BOTTLE-TIT.

“ This cow-bird,” continues Wilson, “ is now six months old ; is in complete plumage ; and repays the affectionate services of his foster-parent, with a frequent display of all the musical talents with which nature has gifted him. These, it must be confessed, are far from being ravishing ; yet, from their singularity, are worthy of notice. He spreads his wings, swells his body into a globular form, bristling every feather in the manner of a turkey cock, and, with great seeming difficulty, utters a few low spluttering notes, as if proceeding from his belly ; always, on these occasions, strutting in front of the spectator with great consequential affectation.

“ To see the red-bird, himself so excellent a performer, silently listening to all this guttural splendour, reminds me of the great Handel contemplating a wretched catgut-scraper. Perhaps, however, these may be meant for the notes of *love* and *gratitude*, which are sweeter to the ear, and dearer to the heart, than all the artificial solos or concertos on this side heaven.”

Here we cannot but remark that the males of nearly all sorts of polygamous birds exhibit some sort of curious display in uttering their notes. Thus, the grouse (*Tetrao*), spread their tails and strut, whilst the nearly allied, but monogamous, ptarmigan (*Lagopus*), do nothing of the kind. Almost all birds that spread out their plumage, like the peacock and turkey, are polygamous. Indeed, birds that never pair are generally distinguished by supernumerary feathers, or by having particular parts of their plumage unusually produced. Thus, the Ruff (*Machetes pugnax*) is the only known species of the sandpiper and plover tribes which is polygamous ; and it is the only one which is distinguished in summer by a remarkable development of feathers about the head and neck. So the bitterns are the only known polygamous birds of the heron kind, and these are similarly distinguished. The bustards also are polygamous, and the males of these have accessory plumage in summer ; and common poultry are polygamous, the males of which have many feathers of their much produced. But the rule does not invariably obtain : many pheasants and polygamous species of ducks exhibit no kind of display, and the monogamous partridges are not thus to be distinguished from the polygamous quails ; and inversely, in certain humming-birds and others, which are known to pair, the males have a very splendid display. The rule, however, is sufficiently general to allow of its being worthy of remark.

COW-PARSNEP is the *Heracleum sphondylium* of Linnæus. This is one of our largest herbaceous plants, and known by the provincial name of kex or kexes. It is very common in damp meadows, and as its seeds are always shed when hay is made, it is liable to usurp too much room in the turf. Grazing the meadow for a few consecutive years is the best way to get rid of it, because the leafy point of the stems is nibbled off by the sheep as soon as they shoot up. It is a very coarse plant in hay, though it does not appear to be ungrateful to cattle. Cow-parsley is another *Heracleum*, but which is a native of Siberia.

COWSLIP is the *Primula veris* and *vulgaris* of Linnæus. If any one plant is better known than another it is this ; every child knows the cowslip ; and notwithstanding its being so common, and in favourable spots in such great profusion, it is always welcomed and admired. There are several unnoticed varieties of this plant ; and it is allied to a numerous family, of which the auricula, polyanthus, and primrose are the chief ; all which are described under the proper names, and in that of the natural order to which they belong. A kind of wine is made from the flowers of the cowslip, which, it is said, is particularly efficacious as a febrifuge.

CRAB. The ordinary English name by which many of the larger species of the crustacea are distinguished, and to which in the Linnæan system the name of *Cancer* was applied. The term however is not exactly synonymous with the latter name, as the lobster, cray-fish, shrimp, prawn, &c., formed portions of the Linnæan genus. Since the time of Linnæus, however, the study of these animals has greatly increased, so that the two Linnæan genera, *Cancer* and *Monoculus*, have been raised to the rank of a distinct class composed of several orders, one of which, the *Decapoda*, or ten footed crustacea, comprises two principal divisions, the *Brachyura*, or those of a broader form and with short tails, and the *Macroura*, having an elongated form and a more developed abdomen. In the former division, the animals known by the ordinary name of crabs are placed, whilst the latter comprises the other species above mentioned ; still, as if to show the total disagreement of the ordinary terms in natural history with their scientific limits, the king crab of the tropical seas belongs to a totally different order of crustacea than either of those above mentioned, whilst even the hermit crab belongs to the *macroura*.

Crabs are for the most part marine animals, frequenting the rocky shores of the ocean, and having the body generally broader than long, although in a very few instances the reverse takes place. As, however, the general structure of the crabs will be found detailed under the article BRACHYURA, we shall here confine ourselves to a few general observations upon the habits of the order. We regret their paucity, owing as it is to the very slight attention which has been paid to the habits of marine animals.

This class of animals, as compared with that of the true insects, is very limited in its extent, but many of the species far exceed in size any of the great division of annulose or ringed animals, whilst some of them are very minute. They are found in all latitudes, but are more abundant in the warm and temperate climates than in more northern regions. Some genera, as *Ocypode*, *Gecarcinus*, *Uca*, *Grapsus*, &c., frequent more southern regions, being found in nearly equal latitudes in the different parts of the old and new

world. Others, as the true crabs, *Portunus*, &c, are more generally distributed, extending from the equator to the polar circles.

The local habitations of these animals are, however, very varied. Some few species of crabs penetrate to a considerable distance inland, but are compelled to return to the sea at the period of coupling and oviposition. Other species, although having the form of the marine crabs, do not quit the fresh water, as in the *Telphusæ*. Again, amongst the marine species, the majority do not quit the shores, whilst others are found at great distances in the high seas, where they can rest only on the floating banks of sea-weeds so abundant in the tropics. And even in those species which frequent the coasts, the same situations are not congenial to them all; some, as the *Dorippe* and *Inachi*, reside at great depths of the sea, from two to four hundred feet, whilst others keep continually at the surface of the waters, passing a great part of their existence upon the shores continually washed by the waves. Some species, again, frequent only the rocky parts of the coast, abounding in madrepores and difficult of access, whilst others prefer sandy shoals, in which they bury themselves.

Amongst the land crabs some species, as the *Ocypode*, make deep burrows, at the mouth of which they ordinarily take their station after the fashion of sentinels, whilst some, as the *Raninæ*, prefer more elevated places, and sometimes even mount the roofs of the huts of the Indians. The crabs are, moreover, the most active animals of the class with reference to their powers of walking, although the *Macroura* certainly excel them in swimming. In those crabs which run fastest the eight hind legs are alone employed, and are terminated by strong pointed hooks. They walk with the same facility, forwards, backwards, and from side to side, indeed in all possible oblique directions. They will also ascend inclined planes, and even almost perpendicular surfaces, provided these planes be not quite smooth. Many, as the *Ocypode* and *Gecarcini*, are noted for their rapidity in running; indeed it is said that a man at full speed would be unable to overtake them. Many species of crabs walk with much less agility than the others, being more decidedly aquatic. They are therefore provided with dilated legs, having the margins furnished with rows of hairs, which are thence converted into natural oars, and by the assistance of which these species are able to perform the same motions in the water as the others do on the shore, and in equally varied directions. Such are the *Podophthalmi*, *Matutæ*, *Portuni*, &c., which have hence acquired the name of shuttle crabs, *Cancer vocans*.

Crabs are in general very courageous, and when their retreat is cut off they stretch out their claws, and endeavour to nip with them, which they do with much force, owing to the size of these parts. Some species, in shutting these claws with violence and rapidity, produce a strong sound; and as they hold their claws in the air with which they make this noise, they have fancifully obtained the name of Calling Crabs.

Crabs, as well as the generality of the class *Crustacea*, feed upon animal matter, especially when in a state of decomposition. Dead bodies, floating upon the surface of the waves, or cast upon the shore by them, are immediately covered with these animals, and there is every reason to suppose that they are attracted by their powers of scent, although the seat

of this sense is not known. Some of the carnivorous crabs even attack living prey, and fight fiercely in order to procure it. In these combats they often lose their claws, which are however soon reproduced, but they never attain the same size as previously. This reproduction of the limbs is one of the most curious circumstances connected with the class, and respecting which we shall give further details in our observations upon the class. In like manner we shall reserve the account of the transformations which these animals have recently been asserted to undergo by Mr. J. V. Thompson, in his valuable *Zoological Researches*, as well as an account of the periodical moulting undergone by them.

CRABRO (Geoffroy). A genus of hymenopterous insects synonymous with Cimbex.

CRABRONIDÆ (Leach). A family, or perhaps rather a sub-family, of hymenopterous insects belonging to the section *Aculeata* and subsection *Fossores* or false wasps. The head is large and nearly square, seen from above; the antennæ often gradually thickened at the tips; the abdomen oval or elliptic, broadest at the middle, or narrowed at the base into a peduncle. The insects introduced into this family may be divided into two distinct sections with reference to their natural habits, which are very interesting: first, the true burrowers, which form their own nests, either in the sand or in decayed rotten posts, and similar situations; these have the fore-legs in general armed with strong spurs to enable them to perform their laborious operations in the construction of their nests; and, secondly, the species which are destitute of these spurs, and which consequently being unable to make their own nests, deposit their eggs in the nests of the other species, and in which the parent fly has already deposited a supply of food consisting of other insects, upon the bodies of which, as well as also (in all probability, although the point has not yet been decided) upon the real inhabitant of the cell, the larvæ hatched from the eggs thus surreptitiously introduced into the cells feed. The genera are, *Trypoxylon*, Latreille, which provisions its nest with small spiders; *Gorytes*, which are considered parasites; *Crabro*, which generally burrow in wood, and provision their nests with the caterpillars of small moths found upon the oak, as well as with dipterous flies*. Some of the male have the anterior tarsi dilated into a curious circular plate; *Stigmus* and *Pemphredon*, which burrow in sand, one of the species of the latter burying numbers of plant lice for the food of her future progeny; *Mellinus*, *Alyson*, *Psen*, *Philanthus*, the larva of which is supplied with bees; and *Cerceres* (which see for a more detailed account of the habits of the last two genera).

CRAMBE (Linnaeus). A genus of herbaceous perennials, one of them a native of Britain, and known by the name of sea-kale. These plants belong to the class *Tetradynamia*, and natural order *Cruciferae*. Sea-kale is found wild on sandy shores, and as it rises with large succulent shoots and unexpanded leaves early in the spring, had been long used as a substitute for young cabbage by the country people in those places where it was plentiful. Near four-score years back it was brought, though partially, into garden culture; but was in little esteem till about

* We have just noticed one of the species of this genus flying along with a crane fly, larger than itself, the legs of which it had previously cut off.

1794, when being then found to be no bad substitute for forced asparagus, particularly at the best tables in the city of Bath, it came suddenly into high repute, and consequently has been extensively cultivated ever since as well in public as in private gardens. The ease and certainty with which it may be forced, so as to have a regular supply throughout the winter, is an additional recommendation, and especially, as it is found to be a suitable supper dish for persons of weak constitutions, and who cannot, at that meal, partake of any kind of animal food.

The plant may be grown luxuriantly in any soil, provided it is loose enough; but its excellence, as a condiment, depends not on its bulk, but on its mild flavour, and therefore means must be taken to grow it in the poorest soil, even pure sand, in order that the naturally rank cabbage flavour may be corrected.

Sea-kale is usually cultivated on beds or borders in any open part of the garden. The body of the bed may be composed chiefly of sea or river sand, to the depth of twelve or fifteen inches. The surface of the bed may be four or five inches lower than the general level of the ground when the seeds are sown or when roots are planted, and then covered with an inch of pure sand. When seeds are used, they are dropped along the middle of the bed in patches, two feet from each other, three or four good seeds together. If they all rise, reduce to two or three at each place, and in the future management, it should be endeavoured to keep the crowns of the plants always as low and near together as possible, for the purpose of covering them with pots or otherwise, when necessary.

The roots, particularly on the upper parts, are thickly studded with buds, so that, notwithstanding the annual loss of the crowns, other shoots are soon afterwards produced from below. This peculiar property of the roots renders a new plantation of sea kale easily made, and which will come as soon into use as if seed had been sown. Either method may, therefore, be followed; and before the winter sets in, the plants will have arrived at a considerable size. All the shoots have a tendency to rise, and the crowns which are to be relied on for the following year's crop, will remain an inch or two higher than the surface after the leaves are shed. This circumstance requires that the crowns be covered with an additional layer of sand, through which the young eatable shoots will protrude in the spring of the following year. If it be wished to have any strong stools, refrain from cutting any in the second year; but if the plants have grown vigorously the first year, a few dishes may be taken without injury.

Many schemes have been practised to induce an early growth of the shoots, because, if the kale do not come in before asparagus, it will be but little esteemed. Deep coverings of pure sand, of coal culm, of decayed light dung or leaves of forest trees, to the depth of a foot or more, have all been used with various success. One of the most common modes is covering the crowns with large garden flower pots, and heaping around and upon these, a ridge of hot stable dung that has been previously prepared by frequent turnings to dissipate the rank steam and heat. The heat imparted from the covering excites the plants into action, and by this means sea-kale may be had in any of the winter or spring months, provided the heating substance be applied seven weeks before the kale is wanted.

Other and equally efficient plans for forcing the crop have been executed. Single rows of plants are put in along the middle of two-foot-wide beds, having two-foot-wide alleys between. The alleys are dug out to the depth of eighteen inches, and the sides of the beds are kept up by open or pigeon-holed brick-work. Six or seven weeks before the kale is wanted, any required length of the beds have the alleys filled with hot dung, and the crowns being covered with pots, hand glasses, or wooden troughs, made for the purpose, and covered over the crowns with additional coverings of mats in severe weather, brings up the shoots expeditiously and in their *purest* state, neither tainted by the effluvia of the dung, nor discoloured or soiled by any matter in contact with them. Neither air or light are necessary to the shoots; perfect blanching not only improves its appearance when dressed, but its flavour also in a considerable degree. It may be repeated, that its excellence entirely depends on the poverty of the soil in which it is grown, and its perfect etiolation. Sea-kale may be raised on very rich soil and of very great size; but few ladies could sit at the table on which it is served up.

But this plant may be conveniently forced in pots, either in a hot-house, hot-bed, or even in any warm corner of a kitchen. Large pots are filled with stout roots among light earth or sand; another pot of the same size is inverted over the first; in this dark prison the shoots are produced, equal in delicacy, though not in quantity, as they can be by any other means. The proper temperature for sea-kale experience has taught is about 55° of Fahrenheit.

CRAMBUS (Fabricius). An extensive genus of small lepidopterous insects, respecting the family of which there is some uncertainty, Mr. Stephens placing them in the *Tineidæ*, Mr. Curtis in the *Pyrilidæ*, and Latreille forming them into a family termed *Crambites*. They are very active, abounding in pastures, and amongst grass, upon the stalks of which they generally rest with their heads downwards and their wings very closely applied, in a convoluted manner, to their bodies, so that they were originally termed close-winged moths, their appearance being nearly that of a cylinder. They take flight very readily at our approach, but soon settle again. The upper wings are long and narrow, their antennæ simple, the labial palpi are stretched forwards, the maxillary spiral tongue is long and slender, and the maxillary palpi very distinct and raised in front. There are nearly forty British species, including the type *Phalæna Pascuella*, Linnæus. Some of them are so exceedingly abundant that scores are disturbed in certain situations at every step. We do not remember ever to have met with them in such abundance as in the month of August on the exposed sides of the Hill of St. Catherine, at the back of the Isle of Wight. Their colours are pale, and they are often ornamented with silvery markings.

CRANBERRY, is the *Oxycoccus Palustris* of Persoon, and the *Vaccinium Oxycoccus* of Linnæus, a common British plant, found on turfy bogs. The fruit of this plant is very generally employed as a kitchen article for tarts. Both the British and American long-fruited cranberries are gathered for sale, and large quantities are annually imported from North America.

The late Sir Joseph Banks advised the garden culture of the American species, and several gardeners have been extremely successful in the attempt. Much

depends on the possession of a suitable site to grow the cranberry. A piece of turfy bog, by the side of a pond, is the natural situation; or an artificial border of bog-earth may be formed, on which there may be no fear of the plant succeeding. This latter project, however, can only be justified by comparing the cost of home-growth with that charged by the retailers of the fruit in this country.

CRANE FLY, one of the names by which the larger species of the dipterous insects belonging to the family *Tipulidæ* are generally termed; they are also called daddy long legs, tailors, &c. They are very abundant in pastures, especially at certain seasons of the year, as at the end of the summer, when they rise in swarms on being approached. Their long legs are of great service to them in enabling them to make their way through the long grass, but these limbs are so slightly attached to the body, that they fall off at the least touch, and the insect flies off, leaving them in the hand when seized, with as little apparent care as though nothing had occurred. Now if this violent deprivation of the limbs were to happen in the higher animals, what would be the result? Is it not certain that death would be the result? And is it not equally clear, that as this does not occur with the insect, that the general construction of the two sets of animals is so completely distinct, that it is impossible for us to judge with precision as to their feelings or senses, which, in all probability, (may we not rather say, absolutely necessarily,) are quite distinct from our own?

The long legs of these insects are likewise very useful to them at the period of depositing their eggs, at which time the body is carried in a perpendicular position, supported by the legs; the abdomen is terminated by an acute point formed of two horny spines, between which the eggs are protruded. This ovipositor is thrust by the insect into the earth, in which the eggs are placed, and as each female lays several hundred eggs, it is curious to see it when engaged in this operation, raising its body up and down, laying an egg each time its tail touches the ground. In this manner it proceeds for a considerable space without ever assuming an horizontal position. The larvæ hatched from these eggs are fleshy grubs without legs, having the mouth furnished with two jaws, and several other organs, and the tail armed with several spines. These larvæ are very injurious by attacking the roots of the herbage, amongst which they have been hatched, and causing the plants to die. And as the eggs are placed so close together, it is not surprising that the larvæ are exceedingly numerous, when this is the case, the whole surface of the ground is of course entirely stripped. When these larvæ have attained their full size, they are transformed into quiescent pupæ, which, previous to assuming the perfect state, perform the same manœuvre of pushing part of their bodies above the surface of the earth, just as we have described the proceedings of the cossus, the cause of which is the same in each case.

CRANE'S BILL is the *Geranium* of most authors. This well-known genus is found inhabiting the northern parts of Asia and Europe, with a few stragglers in North America and South Africa. Nearly twenty species are found in Britain, the principal part of which are herbaceous perennials. Many are ornamental, but none are useful; at least their virtues are unknown. See GERANIUM.

CRANGON (Fabricius). A genus of crustaceous

animals, belonging to the order *Decapoda*, section *Macroura*, and family *Palæmonidæ*, having for its type the common edible shrimp (*Cancer Crangon*, Linnæus; *Crangon vulgaris*, Fabricius). The two anterior legs are terminated by a moveable claw; the second pair of legs are didactyle, slender, and rather longer than the preceding; the rostrum of the shell is short, and the shell itself smooth; the abdomen is rounded; the wrists not annulated, and the legs not provided with a basal appendage. There are several species of this genus, but the most common and best known is that above mentioned, and which is found in great profusion swimming in shoals near the shores with great agility upon their backs. Immense numbers of them are eaten, especially by the inhabitants of the western coasts of Europe. They are caught by means of a large open net, held at the end of a long stick, by women and boys, upon our sandy shores. They are also employed as a bait for several kinds of fish.

CRANIA (Cuvier, Lamarck; ANOMIA, Linnæus). Linnæus included this in his genus *Anomia*, from which Bruguière first separated it, pointing out its distinctive characters. The shell is inequivalve, nearly round, and most generally affixed by its lower or inferior valve. The three indentations, or holes, which are on the internal surface of this valve, appear only to penetrate it, in consequence of the violence necessarily used to detach it from the substance to which it affixes itself by the external surface. Lamarck, therefore, does not consider them to be the apertures through which the animal protrudes certain muscles, in the manner of the *Anomia ephippium*, but merely depressions or cavities in the lower valve of the shell, while it remains closely adhering to any marine body. These holes or cavities give the shell the appearance of a human skull. In some respects it seems allied to the *Terebratulæ*, while the form of it, and being affixed by the inferior valve, would indicate an alliance with the genus *Orbicula*. The writer has seen this shell attached to the root of the red coral, but very rarely with both the valves perfect. In Sowerby's genera of shells, this genus is ably and very minutely described.

Another distinction between this genus and the *Orbicula* is, that the latter are only held in the fissures of rocks, or slightly adhere to them by some muscular fibres of the animal, while the *Crania* has the whole of one valve in immediate contact with the object to which it adheres.

The animal is not sufficiently known to be accurately described. The *Crania personata* is the only species of this genus known: it is so named from its resemblance to a mask. It is classed by De Blainville in the third class *Acephalophora*, first order *Paliobranchiata*.

CRASSATELLA (Lamarck; MACTRA, Gmelin). A great affinity exists between this genus of molluscs and those of the *Macra* and *Lutraria*, it having, like them, the ligament of the valves internal, and attached to the primary cavities of each valve; but when closed, they fit exactly, and do not gape as in those genera. In some species the ligament is partially visible on the exterior, but less so than in the genus *Amphidesma*. The shells of this genus are generally thick and very ponderous—whence the name; they are striated longitudinally, denticulated, regular, subtrigonal, equivalve, inequilateral, the summits clearly defined, and evidently curved forward, the lunule and corselet very distinct; hinge very large, sub-similar, formed by two

cardinal teeth, divergent, separated by a deep cavity; two muscular impressions round, distant, united by the marginal ligula, without any trace of posterior sinuosity; the impression of the retractor muscle distinct. There are eleven species described, all from the Australian seas, and it is somewhat remarkable that many fossil species are found in France, and no where else.

CRASSINA (Lamarck; **ASTARTE**, Sowerby). In appearance this shell resembles a small crassatella, being thick and solid, the valves closing in every part, but it is distinguished from it by the position of the ligament. It cannot either be mistaken for a species of *Venus*, since, on a comparison, it is found to possess not more than two teeth on each valve, and even appears to have but one, very large, on the left valve, the other projecting but slightly. The shell is orbicular, transverse, equivalve, sub-inequilateral, and closed. Hinge with two divergent teeth, and two on the other very unequal. Ligament external, and placed on the longest side. The name of this genus has been properly changed by Sowerby, several species of this mollusc having been described under that name, previously to Lamarck's adopting that of *crassina*, a circumstance he either overlooked or was ignorant of. The *Venus Danmoniensis* of Montague illustrates this genus.

CRASSULA (Linnæus). An extensive genus of greenhouse succulents, natives of the Cape of Good Hope, Linnæan class and order, *Pentandria Pentagynia*; and natural order, *Crassulaceæ*. Generic character: calyx tubular, and five-parted; petals connected at the base, and bearing the stamens; five nectariferous scales below the germen; seed-vessel five-pointed, bursting inwardly, many-seeded. The crassulas are mostly what are called under, or half shrubby plants, with thick fleshy leaves, and many of them bear showy flowers. Like all other succulents, they thrive best in a dry soil, mixed with lime rubbish, to allow of water draining quickly away from the roots. Cuttings strike readily, if allowed to dry for a day or two after they be cut, that the fresh wound may be somewhat dried before placing in the soil.

CRASSULACEÆ—the house-leek family. A natural order of dicotyledonous or exogenous plants, containing nineteen known genera, and nearly three hundred species. In its succulent stem and leaves this order resembles *Cactææ* and *Portulacææ*. It bears an affinity to *Saxifrageæ* and *Illecebreæ*, but differs from these orders in its hypogynous scales. There is no instance of a double flower in the order.

Its essential characters are: sepals from three to twenty, more or less united at the base; petals equal to them in number and alternate with them, inserted into the bottom of the calyx; stamens inserted with the petals, either equal to them in number and alternate with them, or twice as many, those opposite the petals being shortest; filaments distinct, awl-shaped; anthers of two cells bursting longitudinally; a hypogynous nectariferous scale at the base of each ovary; ovaries of the same number as the petals, opposite to them, placed in a circle, distinct, one-celled, tapering into stigmas; several one-celled carpels opening longitudinally and internally; seeds attached to the margin of the suture, varying in number; albumen thin, fleshy; embryo straight; radicle turned towards the hilum.

The plants belonging to this order are succulent

herbs or shrubs with fleshy entire, or pinnatifid leaves, and sessile cymose flowers which are often unilateral.

They are found most abundantly at the Cape of Good Hope. They are also met with in Europe, North and South America, Siberia, the East Indies, and New Holland. None of the species inhabit the West Indies. They grow on dry arid situations, such as naked rocks, old walls, and sandy plains, where there is scarcely any other kind of vegetation. They imbibe nourishment by their whole surface, and do not depend for it on the soil in which they grow. In their properties they are refrigerant, and sometimes acrid.

The chief genera of the order are, *Crassula*, *Sempervivum*, *Sedum*, *Cotyledon*, *Umbilicus*, *Tillæa*, *Globulea*, *Rochea*, and *Rhodiola*.

Of the genus *Crassula* there are several species, some of which are cultivated in our greenhouses on account of their beauty.

The genus *Sempervivum* (live for ever) derives its name from the tenacity of life which is exhibited by its species. *Sempervivum tectorum*, common house-leek, is frequent on the tops of cottages in this country; and is often regarded by the country people with feelings of veneration. Its leaves are cooling and astringent, and when mixed with lard or oil are applied to burns, and wounds. They contain malic acid combined with lime. The fishermen of Madeira rub their nets with the *Sempervivum glutinosum* in order to render them hard and durable.

Sedum telephium, orpine, or live-long, is common on borders of fields and near hedges in Britain. It was formerly considered valuable as a vulnerary.

Sedum acre, biting stone-crop, or wall-pepper, is a common British plant. All parts of it are acrid and pungent. The expressed juice is emetic and purgative, even in small doses. The plant has been used as an antiscorbutic. In Germany it is applied to swellings of the joints, sometimes with considerable benefit. It is a plant which botanists find great difficulty in drying. It will continue to vegetate under great pressure applied at a high temperature. Its vitality must be destroyed by being dipped in boiling water before any attempt is made at exsiccation. The young shoots of *Sedum album* are boiled and used for food in some parts of France. *Sedum rupestre* and *reflexum* are cultivated in some parts of Holland and Germany for the purpose of being mixed with lettuce as a salad. The leaves of the *Umbilicus pendulinus*, wall pennywort, are applied externally as a cooling remedy. *Rhodiola rosea*, rose root, is so called in consequence of its large root; when dry, yielding a smell similar to that of roses. It is common on wet rocks in different parts of Britain, particularly on the Scottish mountains. It is sometimes cultivated in gardens, and is the badge of the clan Gunn.

CRATÆGUS (Linnæus) is the generic name of the well known hawthorn. It belongs to the twelfth class *Icosandria*, and to the natural order *Rosacææ*. The species are mostly natives of the colder parts of America and Europe. The common hawthorn is one of our most beautiful wild shrubs, and universally used as a hedge plant, making an excellent fence, it being self-defended by its thorns, as well as by its stubborn and hardy constitution. There are six ornamental varieties of the common hawthorn, one or two of which bear red or crimson flowers, and which when

in bloom are most attractive objects. The fruit of some of the species, as the azarole, are esteemed in the dessert in the south of Europe, and many are cultivated as ornamental plants in shrubberies. The common sorts are propagated by seeds, the ornamental species by grafting on the common.

CRATÆVA (Linnæus). A genus of East and West Indian ornamental trees. The fruit of one species in the West Indies is called the garlic pear, from some similar quality. Linnæan class and order *Dodecandria Monogynia*, and natural order *Capparideæ*. Generic character: calyx of four sepals, deciduous; petals clawed, limb often deflexed; stamens inserted in a glandular disk surrounding the germen; filaments very long; anthers linear, and somewhat curved, margined at the base; germen on a long footstalk; style none; stigma sitting; berry many-seeded. These plants are kept in our stoves; thrive best in a rich soil, and are propagated by cuttings.

CRATERINA (Olfers; **STENEPTERYX**, Leach). A curious genus of dipterous insects belonging to the section *Pupipara* (or the order *Omaloptera* of Leach), and family *Hippoboscideæ*, or spider flies, and distinguished from *Hippobosca* by having the wings very long, and so narrow that it seems impossible that they can be employed by the insect as organs of locomotion. This family of insects is very curious both in their habits and structure. The females, instead of laying their eggs in the usual manner, retain them within the body, not only until the larva is hatched, but also until it has attained its pupa form, in which state it is deposited by the parent fly. These insects are parasitic upon various animals. The only species, however, of which the present genus is composed (*Hippobosca Hirundinis*, Linnæus), infests the swallow, and, from its large size and the number of individuals sometimes observed upon a single bird, it is evident that they cannot be otherwise than exceedingly troublesome, and even dangerous to this poor bird. The structure of the mouth is very remarkable; it is formed for suction, and comprises several acute bristles.

The nests of the swallow are also equally infested, the insects sucking the young birds as soon as hatched.

CRAY FISH. A crustaceous animal, belonging to the order *Decapoda*, and section *Macrourea*, and forming the genus *Potamobius* of Leach, although Desmarests and others unite it with the lobster in the genus *Astacus*. See **ASTACIDÆ**. An idea of this animal may be obtained from our figure.



Cray-fish.

The cray fish is found in the fresh waters of Europe and the north of Asia. It secretes itself under stones and in holes in the banks, from which it only comes forth to take its food, which consists of molluscous animals, small fishes, and decaying animal matter. It is said to attain to the age of twenty

years, its size gradually increasing all the time, as each year, at the end of the spring, it sheds its outer covering, shortly after which it is found encased in a fresh coat as firm as the old one, and much enlarged, sometimes having increased as much as one-fifth in its size.

The female deposits her eggs two months after impregnation, these she retains for a considerable time beneath her abdomen, keeping them in such situation by means of a viscid matter with which they are covered, and by which they are attached to the false, or swimming legs, with which this part of the body is furnished in its under surface. These eggs increase in size before the exclusion of the young, and are exceedingly numerous. The young ones, when hatched, are extremely soft and small, and entirely resemble their parent, beneath the abdomen of which they shelter themselves for several days. The flesh of this animal is much relished, and various medical properties have been attributed to it, which it is very questionable if it really possesses. It has been remarked, that those which are caught in clear and running streams are of a better taste than those found in stagnant waters and in lakes. They are caught by sinking a net, or spiny faggots, in the middle of which a piece of putrid meat is placed. We well remember the delight with which, in our schoolboy days, we could escape the trammels of Bonnycastle and Virgil, and go groping, with our shirt-sleeves tucked up, in the holes in brooks where the cray fish were met with, and can therefore speak from experience of the sharpness of the bite which they can inflict with their claws. The tops of their claws were, in bygone times, employed in medicine, being considered as a valuable absorbent when pounded. Their place is now supplied in our pharmacopœias by the carbonate of magnesia.

CRENATULA (Lamarck; **OSTREA PICTA**, Gmel.). This mollusc constitutes a very remarkable genus, somewhat resembling the *Mytilus*, but by the great similarity of the hinge it seems more nearly allied to the *Perna*. There is, however, even here a distinct and peculiar difference; the hinge of the crenatula is composed of slightly concave callous crenulations, whence its name. These receive the ligament, while in the *Perna* the hinge consists of parallel truncated linear teeth, or rather rib-like joints corresponding and opposed to the opposite ones, the ligament being inserted only at their interstices. Shells of this genus are thin and extremely delicate; of a foliated texture, resembling the *Placuna*, *Avicula*, and similarly constructed molluscs, more or less irregularly formed; the valves are flattened, foliaceous, and no distinct opening for the byssus; the summits anterior, gaping backward; one muscular impression only, which is subcentral.

The animal is not yet described, but it properly differs but little from that of the *Perna*, which must be considered its immediate congener by analogous reasoning; seven or eight species are known in the different seas of hot countries, but the most part are found in Australasia.

De Blainville classes it in the third class *Acephalophora*, third order *Lamellibranchiata*, first family *Ostracea*.

CREPIDULA (Lamarck; **PATELLA**, Linnæus). This shell is one of the number of those confounded by Linnæus with the *Patella*, which it only resembles

in being apparently constantly fixed to one spot, as the form of their base assumes the shape of the substance to which they adhere; an examination of the animal, however, clearly distinguishes the genera. The shell is an oval or oblong, with a much depressed concave exterior, the spire inclined obliquely to one side, the margin entire, and the opening partially closed horizontally by a partition, giving it the appearance of a half-decked boat; some have angular longitudinal ribs on the surface, others have them armed with spines or prickles; they never possess an operculum, which marks a strong distinction between them and the *Navicula*. The portion of testaceous matter, partly closing the aperture, is placed between the mass of the animal's viscera and the posterior part of its foot. The muscular impression is in the form of a horse-shoe. A very natural association of species will be found as follows: such as have the shell thick, quite flat, and the summit not spiral, as in the *C. porcellana*, the next being nearly of the same form, but very thin and with an epidermis, and the last such as are nearly round, *C. garnotus*, and the summit subspiral, *C. subspirata*.

There are probably ten or twelve species described and about six fossil; they are of the second class *Paracephalophora*, third order *Scutibranchiata*, second family *Calyptracea*.

CREPIDULINA (Blainville; CRISTELLARIA, Lamarck). All the shells of this genus were united by Lamarck in his genus *Cristellaria*. The greater number of them are microscopic, and figured and described by Fichtel, who devoted much time and attention to these minute molluscs. The shell is oval, lengthened, a very small spiral summit; the last turn very ample, oval, nearly straight through its whole length, and closed by a diaphragm of the same form. The *Nautilus planatus* may be considered the type of the genus. Interesting as these small shells doubtless are, as illustrative of the connecting link in the great chain of relationship between the molluscous animals, and important as they must ever be as exhibiting in miniature all the same parts and functions as shells do of a gigantic structure, they nevertheless will only be valued by those who are anxious to investigate nature under every difficulty, and generally speaking to little advantage, since where one species admits of being seen by the power of ordinary optical instruments, there are thousands that are never seen at all but by the use of the most costly microscopes.

CREPIS (Willdenow). A genus of herbaceous uncultivated plants, mostly annuals, and mostly natives of Europe. The flowers are yellow, a good deal like those of the hawkweed, of course they belong to the natural order *Compositæ*.

CRESCENTIA (Linnæus). A genus of West Indian trees remarkable for their large fruit. Linnæan class and order *Didynamia Angiospermia*, and natural order *Solanææ*. Generic character: calyx in two parts, equal, deciduous; corolla, bell-shaped, bellying. limb two lipped, and of four or five lobes, upper lip short and crenated; stamens, rudiments of five; anthers two-lobed; style bearing a bilamellated stigma; fruit like a gourd, large, one-celled, many-seeded, no placenta; seeds compressed and round. This is called the calabash tree in the West Indies; the shell of the fruit being made into various kinds of vessels. The plants are in our collections, and chiefly valued for their fine foliage. They may be propagated by cuttings struck in moist heat.

CREUSIA (Leach). These molluscs, like the genus *Pyrgoma* of Dr. Leach, are the only two genera known to possess four valves, and the operculum to consist of two pieces only. Linnæus classed them with his genus *Lepas*. They are in general small shells, affixed to madrepor or other marine substances, of an orbicular or conical convex form, composed of four unequal valves united, but distinctly marked by a suture at the divisions, the operculum bivalve and internal; a considerable calcareous support penetrating the substance to which the animal attaches itself. They belong to the family *Balanides*, and the animal partakes of the same functions. All the species of this family are so extremely singular and interesting, that it is much to be wished some naturalist, within reach of observing them in a living state, would direct his attention to a careful examination of these animals. In our opinion it would throw a very important light on the organisation of other molluscs, and those imperceptible gradations of change, so remarkable and so unaccountable in their structure, many of which may certainly be traced to necessity, but what has created that necessity, at present remains a mystery.

CRICETUS, hamster, a genus of rodent mammalia, resembling the rats in some particulars, but differing from them in many others. Their teeth are nearly the same, but their tail is short and covered with short hair, and their mouths are furnished with cheek pouches, in which they can carry a store of provisions to their subterranean retreat. The characters of this genus are: larger than the rat; reddish grey above; black in the flanks and underneath, with three white spots on each side; its fore feet are white, and there is also a white spot under the throat, and another under the chest. There are some individuals entirely black. This animal, so agreeably varied in colour, is one of the most hurtful which exists, in consequence of the quantity of grain which it gathers, and with which it fills its holes, which are at times nearly seven feet in depth.

The hamster is confined to the northern parts of the eastern world, and is most abundant in those places which bear a resemblance to the extensive plains to the westward of Rio de la Plata, in South America. In Europe, it is not found to the westward of the Rhine, but in proportion as the sandy plains are approached, it becomes more numerous. One can easily understand why this should be the case; and that it should be so, is a very wise provision of nature; for were hamsters abundant in the most fertile parts of the world, in those which are best adapted for cultivation, and, therefore, most valuable to man, such places would soon be rendered desolate, so rapidly do these animals increase in number, and so great are the ravages which they commit.

In a state of nature, the hamster partakes not a little of the ferocious disposition of the rat; and it has been alleged, that when in a state of confinement they have been known to prey upon each other, as is done by rats, moles, and some other burrowing animals. Still, however, the principal part of its food consists of vegetable matter, a store of which is laid up for at least part of the inclement half of the year, though the probability is that it hibernates the other half. It digs with great facility; each burrow it forms is composed of two entrances, one which conducts to an oblique canal, at the entrance of which the animal throws out and accumulates the earth which it is forced to remove, the other which serves as an exit to a vertical

canal, which is the true entrance to the burrow. These two canals conduct to a greater or less number of particular excavations of a circular form, which, according to the age of the animal, are from about one to five feet in diameter, and communicate together by horizontal conduits. One of these excavations is the retreat of the hamster; it is furnished with a good bed of dry herbs, and it is here that the females bring forth. The other excavations constitute the magazines of provision.

Every animal has its own burrow. The males have usually but two openings to theirs. The females form several by vertical conduits, especially when they have young ones. The burrows of the old individuals sometimes embrace a considerable extent; they descend to four or five feet in depth, and frequently contain many bushels of corn and other grain. They are sought out with great care, as much to collect what they contain, as to destroy the animals which form them, and which, when they are numerous, cause great devastation in the harvest. In the environs of Gotha, it is said, that in a single year eighty thousand of these have been killed; they are discovered by the quantity of earth accumulated at the entrance of their oblique excavation. These rodentia are not merely granivorous, they will also eat flesh, and often devour one another when they meet. Thus it is that, like the most ferocious animals, they live in a solitary manner, and never seek each other but at the season of love. The particulars of their reproduction are not precisely known. The rut, it would appear, takes place many times during the spring, summer, and autumn months; the gestation of the females lasts four weeks, and occurs three or four times in the year; there are usually from six to twelve young ones, which, after a very short lactation, quit the mother to go and dig, each for itself, a burrow, and live by their own resources. These notices apply to

The COMMON HAMSTER (*Mus cricetus* of Linnæus); but the animal is so numerous that a little more minute description may not be improper, and in the first place the characters of the teeth: of the three grinders with which each side of both jaws are furnished, the first in the upper jaw has three pairs of roots, and three pairs of tubercles divided by transverse furrows; the second has two pairs of roots, and two pairs of tubercles. The first in the lower jaw has five roots and five tubercles, and the two which follow in this jaw have four roots and four tubercles. The crowns of the teeth are, however, liable to be worn down with age; but, from their peculiar structure, and their numerous insertions into the jaws, the teeth of these little animals are very powerful for their size, so that they can readily bruise and divide the very hardest of vegetable substances. The eyes are rather small, very round, have a rounded pupil, and stand prominent. The ears are large, and rounded in the naked part. The nostrils open on the sides of a small muzzle, divided by a vertical furrow, which is prolonged across the upper lip; and the lower lip is so small that it scarcely covers the incisive teeth. The size is nearly the same as that of the brown rat, and the chief differences, except in colour, are, that the head is considerably larger, and the tail much shorter. The front, the upper part of the head, the sides of the body, and the upper part of the rump, are dull yellow, mixed with ash colour, the hairs being annulated with yellow and ash, and black at the points. The sides of the head and neck, the lower parts of

the flanks, the outside of the thighs, and the lower part of the rump, are reddish. The point of the muzzle, the lower part of the cheeks, and the feet, are of a very pale yellow, of which colour there are three large spots on each side of the animal. The throat, the breast, part of the fore legs, the inside of the thighs and legs, are deep maroon, passing into black.

There is something very remarkable in the accumulation of fat upon this animal. As it inhabits exposed and arid places, where but little rain falls during the summer months, it might be expected not to accumulate external fat, like the bears which live in covert, and the marmots which, as mountaineers, live near the snow, and are subjected to the variable weather of the alpine summer. But, contrary to the usual habits of animals which are understood to hibernate, the hamster is found with a much greater quantity of fat, internally, in the spring months than in the autumn.— This has been ascertained by direct observation of the most careful naturalists, who have had the best opportunities, and, therefore, it must be received as a truth; and, when along with this, we take into consideration the hoarding propensities of this animal, the argument against its hibernating is considerably strengthened. We believe, also, that few of the inhabitants of low and open places, have a hibernating character, though many of them keep to their burrows during the winter; and we have the evidence of hares and some other rodent animals in our own country, which do not lay up stores of provisions, as proofs that they are in best condition during the winter. The hamster digs its burrow to a considerable depth; and it is generally in soils which are sandy, or otherwise so formed as that the cold of winter does not penetrate them very deeply; and as, when the storm breaks, the transition is from cold to heat at once, without any of those prolonged contests between spring and winter which render more alpine climates so trying to animals, we may, perhaps, conclude that the hamster does not actually hibernate, though it remains in a state of inactivity, and thus not only exists but gets fat upon its accumulated store during the cold weather. In Siberia, during the months of March and April, when the temperature of the atmosphere was very cold, Pallas found that hamsters taken out of their holes had a heat of 103° of Fahrenheit's thermometer; and that others which were dug out from under the frozen earth, in the very depth of winter, had a temperature equal to that of the human body in health, or varying from 91° to 99°.

These are curious facts, and can hardly be reconciled with the notion of dormancy during the winter, although that were not doubtful upon the analogy above stated, that animals of the exposed plains are less exposed to hibernation than those which inhabit more sheltered places. As this is rather an important point, we shall lay before the reader, some of the evidences as derived from the observation of animals which are known to hibernate. The celebrated Hunter informs us, on the authority of Jenner, that the temperature of a hedgehog, in the cavity of the abdomen towards the pelvis, was 95°, and at the diaphragm was 97° of Fahrenheit, in summer, when the thermometer in the shade stood at 78°. Professor Mangili states the ordinary heat of the hedgehog a little lower, at 27° of Reaumur, or about 93° Fahrenheit. In winter, according to Jenner, the temperature of the air being 44°, and the animal torpid, the heat in the pelvis was

45°, and at the diaphragm 48½°. When the temperature of the atmosphere was at 26°, the heat of the animal in the cavity of the abdomen, where an incision was made, was reduced so low as 30°. The same animal, when exposed to the cold atmosphere of 26°, for two days, had its heat at the rectum elevated to 93°, the wound in the abdomen being so much diminished in size as not to admit the thermometer. At this time, however, it was lively and active, and the bed in which it lay felt warm. As the heat of this animal descended to 30°, when in its natural state of torpidity, and when there was no necessity for action, the increased temperature may in part be ascribed to the wound, which called forth the powers of the animal to repair an injury, which could not be done below its standard temperature.

Many similar experiments have been made, and the result of them all is, that the winter temperature of the hamster does not warrant the supposition that, however still it may be during the winter, it ever actually hibernates. For, contrary to what is the case with animals which do hibernate, the temperature of the hamster is as high at mid-winter, as that of the average of animals during the summer, and, indeed, higher; and, though the fact has not been sufficiently examined, it agrees with analogy that, with equal action, any animal should be warmer in winter than in summer; although the temperature of every animal will, of course, sink when that animal remains inactive.

That the temperature of this animal should have been found a few degrees higher in March and April, than it was earlier in the season, is no proof of coming from a state of dormancy, though it is a proof of some action; but the probability is, that this increase had a physiological cause, and was connected with the breeding of the animal. This part of the subject is however obscure, and we want a good deal of careful observation, before we can come to any just conclusion on the very important subject of the seasonal changes of temperature to which animals are subject, both on account of their own nature, and of the circumstances under which they are placed.

Throughout the wide range of territory which it inhabits, the hamster is subject to very considerable changes of colour; and, it should seem that, as it habits more northerly, it fades more into a white colour, and this, again, is in favour of its not being dormant in the winter.

Besides the common species, which is well known, and of which the fur is much used, though not very valuable, there are various smaller species described by Pallas and other naturalists, who have examined the northern parts of Eastern Europe and of Asia.—As the manners of these do not appear to differ much from those of the common species, our notice of them shall be brief.

SAND HAMSTER (*Cricetus arnarius*). This species is said to inhabit more to the southward than the other, and it is much smaller, not exceeding three inches and a half in length. It has the head oblong, the muzzle pointed; the extremity of the nose tumid, and reddish coloured; white mustachios, very furry, and longer than the head; lips very small; ears large, oval, and yellowish; all the upper part of the body of a pearl-gray colour; the under part, including the flanks, the feet, the tail, and even the claws, pure white. It inhabits the sandy plains, feeding on the roots of various plants which grow in these places, and also on the seeds of others. This is a nocturnal animal.

Cricetus accedula is considerably smaller than the hamster. It has the nose rounded, and slightly covered with fur, divided by a furrow which also divides the upper lip. The lower lip, and angles of the mouth, are enlarged, and the cheek pouches are very large, extending down both sides of the neck, as far as the shoulders. The mouth, nose, and coverings of the pouches are white, the rest of the body greyish yellow on the upper part, and greyish white on the under. There are two or three other species, but they are small, and not of much general interest.

CRICHTONITE, a mineral of a velvet black colour, so named by Bournon in honour of Dr. Crichton. It occurs crystallised, usually of a very acute rhomboidal form, and is found in primitive rocks, along with octohedrite, in the different countries where that mineral is found.

CRICKET. The English name applied to several species of insects belonging to the order *Orthoptera* and family *Achetidæ*. Thus the common house cricket is the *Acheta domestica*, the field cricket, *Acheta campestris*, and the mole cricket *Gryllotalpa vulgaris* (*Gryllus Gryllotalpa*, Linnæus). All these insects are evidently distinguished by the chirping creaking kind of noise which they produce, whence evidently the origin of the English name. It should be borne in mind, however, especially when consulting foreign works upon entomology, that the *cricquets* of the French authors are different from those of our own language; our crickets being by them commonly called *Grillons*, (and scientifically *Gryllus*, whereas they ought decidedly to bear the name of *Achetæ*, being the Linnæan *Grylli Achetæ*,) whilst the name of *Cricquet* is given to the true locust family, the *Locusta* of the ancients, and the *Gryllus Locusta* of Linnæus. We cannot conceive why authors who have done so much for the science which they have so assiduously cultivated, should yet persevere in so evidently incorrect a nomenclature.

The cricket family is distinguished from the locust family, as well as from that of the grasshoppers, having long antennæ, by having the wings and wing-covers carried horizontally when at rest. The former extending beyond the latter in slender fillets, and the latter having a small circular space covered with a glassy membrane in the males, which is employed in producing the noise whence the insects have derived their name. As the females are destitute of this, they do not possess the power of chirping; the tarsi are composed of only three joints.

As the family *Achetidæ* was omitted in its alphabetical situation, we have thus given its characters under the popular heading, rather than omit them altogether. The genera are by no means numerous, namely, the *Acheta*, *Gryllotalpa*, *Tridactylus*, and *Myrmecophila*.

In *Acheta* the legs are slender and formed only for running and leaping; the females are provided with a long and slender exerted ovipositor at the extremity of the body, and the antennæ are very long and slender.

The house cricket (*Gryllus domesticus*, Linnæus; *Acheta domestica*, Fabricius), is too well known to need much description. It is of a yellowish buff colour, varied with brown, and frequents the interior of our houses, especially where fire is continually kept, burrowing behind the chimney and grate, and multiplying in such situations to such an extent, that, independent of their disagreeable chirping (which, as

"de gustibus non est disputandum," is nevertheless liked by some persons), they become from their numbers a perfect nuisance, flying into the candles and dashing into people's faces, according to White. In families, at such times, they are like Pharaoh's plague of frogs, in their bed chambers, and upon their beds, and in their ovens, and in their kneading troughs. The strong chirping noise which the males make is occasioned by a brisk attrition of their wings, the glassy parts above mentioned acting like the parchment covering of a tambourine. This noise is chiefly produced at dusk, and during the night, although occasionally it may be heard during the day. The insect, however, is certainly a nocturnal one. As their presence in a house is regarded by some persons as ominous of ill luck, whilst others as firmly believe them to be prognostics of good, they may be especially referred to as a proof of the absurdity of those superstitious feelings which we trust the diffusion of knowledge is fast driving away. Their food, according to White, consists of crumbs of bread, yeast, salt, and any kitchen offal or sweepings. Latreille, however, says they thrive well in houses infested by cockroaches, upon which they feed, and they will certainly eat their own species when placed in confinement, but we should scarcely think this natural. They are very fond of moisture, preferring the moist mortar of new buildings; they will also gnaw holes in wet woollen stockings and aprons hung to dry; and one of the best modes of catching them is to place phials or other vessels half filled with beer, milk, broth, or the like, for being always eager to drink, they will crowd into the vessel and be drowned. They bring forth their young at all times of the year, as young ones may be found even in the winter months swarming on the hearth not larger than fleas.

The field cricket, *Acheta campestris*, is a much rarer animal than the former; it is of a black colour, with the base of the wing-covers yellow, the head is large, and the hind thighs red underneath. It burrows at the side of footpaths in hot situations exposed to the sun, making deep holes, at the mouth of which it sits, in order to seize upon stray insects which are its food.

The mole cricket is a curious animal, deriving its name from the similarity both of its structure and habits to the mole. The antennæ are short and slender, and the fore legs very broad and notched, being very powerful and well adapted for burrowing under ground; the abdomen is terminated by two long slender and hairy bristles. This insect, which, with some trifling variations in structure, is found all over the globe, is an inch and a half or two inches long, nearly cylindric, and of a brown colour.

It is a noxious animal, committing much injury in gardens and cultivated ground, burrowing a short distance beneath the surface, with the assistance of its large palmated fore legs. In this manner it loosens the roots of vegetables, upon which indeed it is said to subsist. Latreille however thinks, that it feeds upon underground insects or worms. The noise made by the male insect (and which is only heard during the night or at twilight), is said to be agreeable. The female forms in the month of June or July a subterranean chamber of an oval form, quite smooth internally, and about six inches deep, in which it deposits from two to four hundred eggs. The nest with its curved entrance somewhat resembles a flask with a bent neck. The young when hatched live for some time in society.

CRICOSTOMATA (genus *Turbo* of Linnæus). This is the name given to the second family of the second order *Asiphonobranchiata*, of the second class *Paracephalophora*. It may be observed that this family is scarcely to be distinguished from the Linnæan *Trochus*, which in fact is blended by almost insensible distinctions with his genus *Turbo*, and it is only, therefore, with a view of assimilating his labours as much as possible with the modern school, that the family *Cricostomata* has been established. This is only one of many instances which this work will exhibit of the veneration justly paid to that great naturalist's judgment, from which present authors presume not to differ, without pointing out conclusive reasons, and manifest cause for so doing.

A general description of these shells is, that they are of a variable form, but the aperture always nearly circular, and completely closed by a calcareous or horny operculum, the whorls of the spire few in number, and the summits sub-lateral.

The animal consequently is variable in form, but this applies rather to its exterior and some of its proportions, than in anything material in its organisation, which is the same in all the family. The animal appears always phytophagous; a small portion of them naturally breathe air, and the greater number of the aquatic species are marine. The various genera of this family will be noticed in their alphabetical arrangement.

CRINOIDEA. There is perhaps no result more extraordinary in the annals of modern research, than the discovery of the very remarkable and various changes which this our planet has evidently undergone, as indicated by the successive development and subsequent destruction of beings once animated, whose existence could never have been even suspected by us, had not their remains been still preserved in a fossil state. Whole tribes of animals seem to have been called into being, and after having for a certain period peopled the earth, appear to have gradually ceased to exist, in consequence of certain unknown causes which must for ever elude our inquiries, giving place to others of totally different forms, which in the course of subsequent ages were in like manner destined to pass away, their situations in the chain of animal life being replaced by other and possibly more perfect creatures, until we at length arrive at a point at which the inhabitants of this earth differed but slightly from the varied productions of the present time. Among these none are more remarkable than the remains now under consideration, not only on account of their curious forms, the beauty of their articulations, and the complicated nature of their structure, but also from their having evidently been among the earliest inhabitants of this world. Hence they are so far removed from the present order of animated nature, that although immense ranges of rocks may literally be said to be formed of the mineralised remains of different species entombed in them, but five or six fragments of one of these numerous species have hitherto been found in the recent state. Their fossil columns and joints, however, from their frequent occurrence and singular forms, attracted the notice of naturalists at an early period, and they consequently acquired names founded either upon certain superstitious ideas, or upon a fancied resemblance to other bodies, and the uses to which such bodies were applied. Thus we find them termed "giants' tears," "rosary beads," "fairy stones," "wheel stones," "entrochites," while the star shape of the

angular columns, occasioned them to receive the names *starstone*, *asteriæ*, &c.

By some these bodies were considered as inorganic filtrations, similar in their nature to stalactites. By others they were looked upon as the vertebral joints of fish, or as portions of some unknown species of coral. While others, who had more accurately observed the column and its termination, compared them to plants, whence they obtained the name of the stone lily, in consequence of the shape of the superior extremity of some of these remains, which very closely resembles a flower of that kind. They were at length considered as appendages to star fish, and were therefore supposed to have probably belonged to the *Asteria*, and as it was thought probable that they might yet exist in unexplored parts of the ocean, researches were anxiously set on foot to discover them in a living or recent state. At length a portion of an animal was found which bore a strong resemblance to the asterial columns so frequently found in the *Lias* and *Oolite*, and which, upon further investigation, appeared to possess an absolute identity of generic characters. Linnæus classed this species under his genus *Isis*, calling it *Isis asteria*. Lamarck, however, finding it did not agree in its characters with that genus, removed it to his genus *Encrinus*, terming it *Encrinus caput Medusæ*.

The fossils were however found to admit of at least two generic divisions, distinguished by the shape of the vertebræ. The one, the *Encrinus*, having them chiefly of a cylindrical form, and the other, the *Pentacrinus*, in which the vertebræ are principally pentagonal. Under these names, various species were formed, and which are described by Parkinson as the lily, cap, turban, stag's-horn, &c. encrinites.

Since that time this family has been most ably illustrated by the researches of Mr. Miller, who, in his "History of the Crinoidea, or Lily-shaped Animals," has reduced these remains into genera and species, in the most satisfactory and scientific manner.

By him these numerous and interesting remains of animals of former times, which were before loosely described under the appellations of *Encrinites* and *Pentacrinites*, are classed as the members of one distinct and peculiar family, distinguished as the crinoidea, or lily-shaped animals. The members of this family are placed under four principal divisions, comprising nine genera, each containing several species, most of which were before that time very imperfectly described, and some of which were even utterly unknown.

The name *Crinoidea* is derived by him from a Greek word, signifying lily-shaped, and he defines the general character of this family as "an animal with a round, oval, or angular column, composed of numerous articulating joints, supporting at its summit a series of plates or joints, forming a cup-like body, containing the viscera, from whose upper rim proceed five articulated arms, dividing into tentaculated fingers, more or less numerous, surrounding the aperture of the mouth, situated in the centre of a plated integument, which extends over the abdominal cavity, and is capable of being contracted into a conical or proboscis shape."

In his first division, the joints, which form the inferior cup-like body of the animal, articulate with each other, whence the name *Articulata* given to this division, which contains three genera: *Apiocrinites*, the pear-like lily-shaped animals, having two species;

Encrinites, the true lily-shaped animals, containing one species; and *Pentacrinites*, five-angled lily-shaped animals, comprising five species.

In the second division, the plate-like joints forming the cup, containing the viscera, articulate imperfectly with each other, from which circumstance it receives the name *Semi-articulata*. In this division he has but one genus, the *Pateriocrinites*, or vase-like lily-shaped animal. Of these he describes two species.

His third division he names *Inarticulata*. In this the plates adhere by sutures, lined by muscular integuments.

These he divides into *Platycrinites*, broad-plated lily-shaped animals, six species; *Cyathocrinites*, or cup-like lily-shaped animals, four species; *Actynocrinites*, or radiated lily-shaped animals, three species; and *Rhodocrinites*, or rose-like lily-shaped animals, one species.

The fourth division contains those having the joints of the pelvis anchylosing to the first columnar joint; this has one genus, the *Eugeniocrinites*, of which but one species was then known to exist.

Since the publication of Miller's work, many new genera have been discovered, many of the species have been subdivided, and the genus *Apiocrinites*, in particular, has been very fully elucidated by the researches of J. Channing Pearse, Esq., F. G. S., who, in a highly interesting paper, "On the Oolite formation and its contents, as shown in a quarry at Bearfield, near Bradford," lately read before the Geological Society, but not hitherto published, has exhibited evidences of the most profound research and minute inquiry, joined to a close attention to the scientific arrangement of these bodies, highly creditable to his talents and observation; and as the information contained in that paper is perfectly new and also of great interest, some account of his labours may not prove uninteresting.

The first species of Miller, viz.: the *Apiocrinites rotundus*, is the one to which the observations of this gentleman more particularly apply. This he proposes to divide into three species. He was led to form these distinctions from his peculiar advantages in living upon the spot where these remains are found in great abundance, and consequently being able to procure them in greater perfection than any collector had hitherto been enabled to do. In their generic description, he states them to be composed of a root or pedicle, from which rises a round column, having at the top a pear-shaped head, which supports arms and fingers, containing a series of cavities in their interior, which he considers as having contained the stomach and alimentary canal. The whole animal is composed of a vast number of flat joints or plates, which articulate with each other by lines radiating from the centre, which are, as it were, dovetailed into the next joint, and in like manner receive the radii of that joint. He supposes that they were covered externally with an epidermis, or skin, which was muscular, by the contraction of whose fibres, lateral motion in every direction was produced, by which means they were enabled to search for food wherever it might be found within their reach. The root or pedicle consists of a number of concentric laminæ, forming a cone, which surrounds the central column, the base being placed at the lower part, or at the point where the animal attached itself to rocks, &c., and, by forming a sort of buttress or support to the column, added very materially to its strength.

These plates appear to have been secreted from the edges of the joints, at the points of articulation with each other; and he mentions a specimen which, having been injured, exhibited this secretion actually going on in the form of little globules attached to many of the joints at their articulations, and he supposes that this animal, when injured in any part, performed the restorative process by exuding the matter in question in the manner just described. These pedicles are found of various sizes, some not exceeding a quarter of a line in diameter, others being at least two inches; sometimes a number are found together, either attached to corals, shells, or other hard bodies, or, as most frequently, to the rock itself. This junction of the pedicles, in many specimens, produces the appearance of a number of columns emanating from one common root, but by making a section they are all found to be separate animals, as the columns may then be perceived to be perfectly distinct from each other, passing through the mass, each surrounded by a cone formed of concentric laminae, which cones, by the exudation before mentioned, have, outwardly, become so intermingled with each other, as to form apparently but one mass.

The longest animal of this kind met with by this gentleman, he describes as composed of 158 joints, forming a column about ten inches in length, the circumference of which diminishes slightly above the pedicle, but continues of the same size (viz. about an inch) until it arrives at the upper part, where it expands to the extent of four or five inches. The seat of the greatest motion appears to have been about the centre of the column, which is shown by its increased strength of articulation in that part, exhibited in the radiating grooves being very deeply marked, whereas in the upper and other parts, where but little motion was required, these indentations are exceedingly minute. This column is composed of rings which are thicker at the circumference than at the centre, each being perforated in that part with a round hole, and thus the lenticular cavities formed by the juxtaposition of the plates are connected together.

The head consists of the enlarged columns, to which are attached five wedge-shaped joints, five inferior and five superior costal joints, and five bones called scapulæ, to which are articulated ten arms, which are furnished at their sides with a number of feelers, forming a sort of fringe. The upper or columnar joint has five radiating elevated ridges upon its upper surface, between which are the attachments of the five wedge-shaped joints, which are triangular and flattened at the lateral edges, being the points where they are articulated with each other, having two equal articulatory faces at their upper surfaces, divided by an elevated ridge, above which the five inferior costal joints are placed, which are also of a triangular shape, and are connected with each other by lateral attachments, and present a cavity above, which receives the superior costal joints, which in like manner receive the scapulæ. It appears probable that an intervening muscular organisation existed between the articulating faces of the joints, from the wedge-shaped ones upwards to the scapulæ. There is also a gradual approximation of their internal and external edges, and this, joined to their circular arrangement, produces a conical cavity with the apex downwards. Mr. Pearse suggests that this was probably closed above, as that of the pentacrinite, with an integument composed of a membrane covered externally with scales

of an angular form, forming the cavity of the stomach; between the wedge-shaped joints five canals are also found passing from the lower part of the stomach, each of which terminates in an opening on the external surface, the mouth of which is marked either by a depression or an elongation which sometimes extends to the distance of an eighth of an inch, which openings he supposes to have been the mouths of the oviducts. To the superior surfaces of the five scapulæ are attached the ten arms, which appear to have consisted of at least forty or fifty joints, shaped like a horse-shoe, which are articulated to each other, and gradually diminish in size; as they approach their upper extremities a small perforation penetrates each joint, as before described in the vertebral column, through which foramina it is possible the vessels for their nutriment, or the ligaments by which they were attached to each other, had their passage. The arms have also a groove running the whole length of their inner surface, while the outward one is of a rounded form, and to the holes of each joint of the arm is attached a finger whose joints are at first round, but afterwards grooved at their external edges, and which are also perforated. Each arm when perfect must, according to this description, have had from forty to fifty fingers attached to its sides, placed alternately, and thus presenting a fringed appearance.

He names his first species *Apiocrinites globosus* from its having the head in a very globose form. It is shorter than the other two species, and the irregularities on the surfaces of the joints, which were probably produced by muscular contractions, are very faintly marked.

The *intermedius* has the head elongated, with no corresponding lessening in the circumference, or thickening of the joints, which are thin and deeply crenated, and the muscular impressions, as in the *globosus*, but faintly shown.

The *Elongatus* is distinguished by the head being very greatly elongated in many specimens, tapering down nearly to the centre of the column; the plates are also at least three times thicker than those of the other two species. The column is also of much greater length, without any corresponding diminution of circumference. The development of the various articulatory surfaces is also very strongly marked, and the plates have a tendency to become more acute at their edges, than in the other species. The radii on the surfaces of the plates of the column are so slightly marked as to be scarcely visible, and on each of the surfaces of the joint a central depression is found, which is occasioned by the joint becoming at once two-thirds thinner at that place than the surrounding portion. This is also seen slightly in the two other species.

Such is a summary of the account given by Mr. Channing Pearse, the whole of which deserves the particular attention of all those who make organic remains their study.

The geological distribution of the *Crinoidea* is also highly interesting. They occur in all the formations, commencing with the transition limestone, in which impressions and portions of these animals have been found. Their great depôt, however, is in the mountain limestone, in which no fewer than twenty of those described by Miller are found, together with many of the new genera and species not known to him. They are also abundant in the lias, in which, however, several of the species found in the lower formations disappear, and others of hitherto unknown genera occur.

Some, as the *Apiocrinites rotundus*, are found in the oolitic formation alone, while *Apiocrinites ellipticus* occurs only in the chalk, and another, supposed to be the *Pentacrinites caput Medusæ*, appears to have continued from the deposition of the lias until the present time, forming one of those links between a former state of existence and the present appearance of animated nature, of which so few are to be found even after the most patient and laborious research.

CRINUM (Linnæus). A genus of magnificent bulbous stemmed plants, natives of warm latitudes in all quarters of the world. Linnæan class and order, *Hexandria Monogynia*; and natural order, *Amaryllidææ*. Generic character: spatha including many flowers; germen either sitting or on a short pedicel; perianthium tubular at the base; limb regular, spreading, six-cleft; segments alternately furnished with a nail at the point; stamens inserted into the tube, erect; filaments awl-shaped; anthers incumbent. This is one of the most stately of its order; the roots, stem, leaves, and flowers of most of the genus are all ample, and consequently require large pots, a rich loam, and much head-room to grow in perfection. They flower frequently in the stove, and are propagated by off-sets which they occasionally produce. But if suckers are not produced naturally, the plants may be easily made to send them forth plentifully, that is, by cutting down the stem to prevent flowering. The *C. amabile* is one of the largest and most valued of the genus, and not so much for its frequent flowering, as for its rich and powerful fragrance.

CRIOCERIDÆ (Leach). A family of coleopterous insects belonging to the section *Tetramera*, and forming the subsection *Eupoda* (Latreille), having the body of an elongate form, with the head and thorax narrower than the abdomen; the antennæ filiform, or thickened towards the tips, inserted in front of the eyes, which in some are entire and round, whilst in others they are slightly notched in the inside; the head is deeply inserted into the thorax, which is cylindrical or transversely square; the abdomen is large, compared with the rest of the body. The tarsal joints, with the exception of the last, are furnished beneath with cushions, the penultimate (or rather the antepenultimate) being bifid or bilobed; the hind legs are greatly dilated in some of the species, whence the term of the subsection is derived. These insects are essentially herbivorous in their larva and imago states; many prefer the lily tribe, upon the leaves of which the larvæ feed. Those of the *Donaceæ* feed within the stems of various aquatic plants upon which the perfect insect is found very abundantly. The species are for the most part of small size, but elegantly ornamented with various colours. Latreille divides the family into two tribes.

First, the *Sagrides*, having the mandibles terminating in an acute and entire point, and the lower lip deeply cleft; the hind legs are generally very large. Here belong the Brazilian genus *Megalopus* and the Chinese and African genus *Sagra*, together with *Orsodachna*.

Second, the *Criocerides*, having the mandibles truncate at the tip, with two or three strong teeth, and the lower lip entire. *Donacia* (which see). *Macrop læa* (*Hæmonia*, Meig.), *Crioceris*, *Zeugophora* (*Auchenia*, Latreille), all of which are British, and *Petauristes* and *Megascelis*, exotic genera.

The genus *Crioceris* is distinguished by having the antennæ short, the maxillary palpi filiform, and the

hind legs not differently formed from the anterior. The eyes are notched, the hind part of the head is narrowed into a kind of neck. The insects of this genus live upon liliaceous plants, asparagus, &c., and make a slight noise when handled; their larvæ also feed on the same plants, to which they hold tightly with the assistance of their six short legs. The body of these larvæ is short, thick and fleshy; and in order to guard themselves from the attacks of their enemies and the changes of the weather, they form a covering of their own excrement, similar to that constructed by the larvæ of the *Cassidæ* (which see). When they have acquired their full size they descend to the earth to undergo their transformation.

Reaumur has given the most complete account of the proceedings of these insects. The figures referred to by Mr. Curtis do not represent a merdigerous species as described by him. There are seven British species, including the type *Chrysomela merdigeræ* (Linnæus,) which is found upon the white lily. The larva of the pretty asparagus beetle, *C. asparagi* does not form an excrementitious tent*.

CRISTARIA (Schumacker). This genus of shells was constituted by Schumacker, but has since been united with the genus *Anodon*, of which it must only be considered a division. The shell is oval, rounded, gaping at the ends, with something resembling a crest at the summits, and a long longitudinal callosity, divided into two plates by a linear cardinal indentation.

CRITHMUM (Linnæus) is the generic name of the British maritime plant samphire, found on rocky shores, and cultivated in some places and disposed of for pickling. It affects a very light sandy soil, and belongs to the natural order *Umbelliferaæ*.

CROCODILE—*Crocodylus*. A genus of saurian reptiles, forming, along with the alligator and the gavial, a well marked and very distinct family, the largest, most powerful, and the only ones which are in any way dangerous to the human race. Some account of the more remarkable species of alligator will be found under that title, in its order in the alphabet, so that we shall have here only to notice the two remaining genera, the account of which we shall be enabled to shorten, by bringing them both into one article.

The characters of the whole family are: size very large; tail flattened on the sides; fore feet with five toes, hind with four, of which the outer one is without any claw; all the feet are more or less webbed; a single row of teeth in each jaw; the tongue fleshy, flat, and so much attached to the sides of the under jaw, that the ancients supposed it to be wanting; the back and tail covered with large and strong scales of a square form, ridged at the middle; and a crenated scaly crest along the tail, forming a double row at the basal part; the scales on the under part are square, but small, smooth, and without any keel.

The mouth of these reptiles is a very formidable instrument, although it does not answer all the descriptions that have been given of it. The lower jaw extends farther back than the upper, so that there is room for the insertion of very powerful muscles, both for opening and for closing this jaw, the motions of which are as extensive as they are powerful. It is not true, however, that these animals have a motion in both jaws, as was believed by the ancients, and is

* At the present time (middle of June) the asparagus, which has been left uncut in our garden, is swarming with this insect, not only in its perfect state, but also in that of the larva.

still asserted in some of the works on natural history ; and it is easy to see that such a motion would do them harm rather than good.

There are some of the serpents which can not only turn both jaws till they are in the same plane, but distend the opening considerably beyond the mere measure of the two jaws, when they have occasion to swallow large prey. But the mouths of these serpents do not form an analogy for the mouths of the crocodile family. In serpents, the mouth is generally only a swallowing apparatus, and those which capture large prey are either poisoning serpents, which kill by the fangs, or crushing serpents, which kill by the folds. The crocodiles, on the other hand, are biting animals, which kill with the mouth ; and such animals would have little or no power if they had a motion in both jaws. The action of muscle against muscle in an animal, would be the least profitable way in which it could exert its strength, as the effect would be only equal to the difference of the exertions after the stronger muscle had forced the weaker one to a state of rest ; and thus, the animal would lose an effort equal to double that made by the weaker muscle. There are no such mechanical bungs as this in nature ; and it is a good rule in judging of the truth of what is alleged of any animal, to consider whether that which is alleged is consistent with the utmost perfection of mechanical skill—the producing of the greatest effect by the least exertion ; and if this is not the case, we may rest assured that that which is alleged is not true.

The nostrils of the crocodile are formed externally of two slits which cross each other, the angular pieces between serving as little valves to close the aperture when necessary ; they lead by a long canal through the palatal and sphenoid bones to an opening in the back part of the mouth ; the ear closes externally by means of two fleshy lips, which close it like valves ; the eyes have a third eye-lid ; and there are under the throat two small holes, which lead to glands secreting an unctuous matter which smells very strongly of musk. So abundant is the quantity of this matter, and so powerful its scent, that in warm countries, where crocodiles are abundant, they perfume the whole country around the rivers.

The vertebræ in the neck of the crocodiles are furnished with a sort of false ribs on the sides, which hinder flexure in that direction, and thus the animal cannot turn its head very readily aside, or even turn its body (for animals which have the neck stiff always have difficulty in turning laterally). But the crocodile can turn the neck very readily, so as to elevate the head till the line of it forms less than a right angle with that of the body ; and it can also move the head very rapidly from this elevated position to one rather lower than the horizontal line.

These motions of the neck answer better with the habits of the animal than if they had been in the other direction ; for the crocodiles do not pursue their food either along the banks of the rivers or in the water. They are liars in wait, as is the case with all large and heavy animals of predatory disposition, unless it be those species which have the wide sea for their field of chase. The crocodile is a powerful animal even upon land ; but its chief scene of action is in the water, where it watches by the places to which land animals come to drink, with only the point of the nose above the surface ; and as, at these times, it is perfectly still, other creatures approach near it with-

out being aware of their danger. When the animal comes sufficiently near, the mouth of the crocodile opens rapidly to a great extent by the bending backwards of the head and upper jaw upon the joints of the neck as a centre of motion, and the moving of the under jaw in the other direction upon its own articulation. Thus, in the opening of the mouth, there is a motion of both jaws from each other ; and when they are again closed, the upper jaw does descend to meet the lower one ; but the motion of the upper is not against that of the lower, as they are not articulated on the same centre or the same bone. Hence the peculiar motion increases the force of the bite instead of diminishing it ; as the bite is given with both jaws, which, when they come to a state of rest, the upper offers a point of solid resistance to the under.

CROCODILES, properly so called (*Crocodilus*). The name “crocodile” is Greek, and means that which cries, yelps, or screams, along the bank of the river. The true crocodiles are the most powerful and ferocious of the race. The characters in which they differ from the gavials are: the muzzle oblong and depressed, the teeth of unequal length, but the four front ones below do not fit into holes in the upper jaw, as in the alligators. There are several species or varieties ; and there are in the West Indies, in the rivers of the larger islands, some which have the muzzle of the crocodile form.

CROCODILE OF THE NILE (*Crocodilus Niloticus*). This is the animal which is meant whenever the crocodile is mentioned without any farther explanation. It has long been known, and there are few animals of which so many stories have been told. There is not much use in repeating any of those stories, though we must not judge of the animal altogether from what is observed of it in Lower Egypt, which is the most northerly latitude in which it is found, and therefore it must have less energy than those in the south. With the exception of the elephant, the rhinoceros, and the hippopotamus, the bulk of the crocodile perhaps exceeds that of every terrestrial animal ; no fishes frequenting fresh water equal it, and but a few species of those belonging to the seas. The largest are not less than thirty feet in length, and one of only half that size is five feet in circumference ; the body stands low on the ground, and the animal universally presents a dull and sluggish aspect. Nevertheless, its motions in pursuit of prey are not slow ; and the difficulty which it finds in turning is the surest means of escape on land ; its agility in water is infinitely greater.

These facts are better illustrated when the animal is roused to action. Its natural abode is in the water, for scarcely one fourth of its existence is passed on the earth ; whence those narratives which affirm that it lives entire months without that element, are not easily to be credited. The muddy edges and thick reeds of slow and tranquil streams are its favourite haunts ; and it sometimes descends rivers to within the flowing of the tide. On leaving them it advances always with a slow pace, nearly in a straight line, its belly frequently dragging on the ground, and its head commonly elevated before it. However, it is seldom seen standing, and its chief enjoyment seems to be lying in a state of absolute quiescence. When in pursuit of prey, it swims gently and silently, just on a level with the water, until it approaches the place where some terrestrial animal comes to quench its thirst. Then curving its tail, it strikes the animal a

violent blow, which is invariably in the direction of the water, and at the same time towards its own mouth. Should the animal surprised be of large size, such as an ox or a horse, the crocodile adopts another manœuvre, in seizing it by the nostrils, and forcibly dragging it under the water to be drowned. When a tortoise is seized, the crocodile raises its head above water, and with the inconceivable strength of its jaws, crushes the shell in pieces. Men, and particularly negroes, are said to be its favourite prey, and it is greedy after the flesh of dogs; and hence, the negroes that hunt the crocodile are accustomed to beat the dogs on purpose that their howling may attract it from its haunts. The prey being drowned, is conveyed to some sub-aquatic hole or receptacle, and left to putrefy before it is devoured; but the crocodile cannot feed in the water; it would then, as is usually credited, experience the same fate as its victim; therefore, except small fishes, the prey is always carried to the land. Its structure also is such, that it must rise to the surface once in an hour, or hour and a half, for breathing. Nothing that it once seizes can escape; it never quits its hold; even strong levers forced between the jaws for that purpose have proved ineffectual; and, shaking its prey to pieces, it is swallowed without mastication. Much has been said of the stratagems employed by the crocodile to seize its prey; that it lies like a log on the banks of rivers, or floats inactive on the surface, and then springs forward whenever the victim comes within its reach. This may be partly true, though it appears under many exaggerations; for it is well authenticated, that it remains motionless until considerable objects are quite close and evidently within its reach, then it leaps upon them. The agility of the crocodile is not so great, even when in pursuit of prey, that a man may not escape at tolerable speed, more especially by frequent deviation from the straight path. The blow with the tail, suddenly given, is principally to be dreaded, and the irascibility of the animal when attacked, or the female at the head of her young.

It does not appear that the crocodiles are so numerous in the lower part of the Nile as they were in ancient times, and the few that do appear are now not much dreaded there—but farther up the river where the climate is warmer. But Lord Prudhoe, while travelling in Sennaar, between the black and white Nile, in the averaged latitude of about 14° north, found that they were much more formidable; and during his sojourning in the country several of the natives were carried off by them; and the banks of the river were in many places so musky in their smell as to be very offensive.

Crocodiles are oviparous, and the eggs are but small in proportion to their size, not being quite so large as those of a goose. They are, as is the case with the eggs of reptiles generally, equally thick at both ends, they are covered with an envelope which hardens in the air, but it contains very little carbonate of lime. The males are more numerous than the females, and fierce battles ensue between them in the pairing time. These battles of gallantry are generally decided in the water, and they are accompanied by the most dismal bellowing that can possibly be imagined; this noise is said to resemble that both of the bull and the bittern, but to be much louder and more husky and dismal than either.

The female digs a cavity in the earth, in which she places her eggs, in a circular form, in successive layers,

and with portions of earth between, the whole being afterwards covered up.

This nest is generally placed in a dry hillock, and the earth is gathered up, so that on the average, the eggs are about ten inches below the surface. This being done, the mother abandons them to be hatched by the heat of the sun; yet instinct prompts her frequently to revisit the spot as the term of exclusion approaches. She then testifies uncommon agitation, roaming about the place and uttering a peculiar growling, as if to awaken her hideous offspring to animation. The period of maturity being at length attained, the nascent crocodiles answer to her solicitude by a kind of yelping like puppies. A hollow murmur in return denotes her satisfaction, and she hastens to scrape up the earth with such anxiety, that several of the young are generally crushed under her unwieldy body. Having withdrawn them from their nest, the mother leads them straightway to the neighbouring water; but now her utmost vigilance is required for their preservation, for, unlike the instinct with which she is animated, the male, silently approaching, will frequently devour them before she is aware of her loss. He perpetually seeks their destruction; and the watch of the female over her young is protracted for three months from their first appearance. An opinion is prevalent that the crocodile continues growing during its whole existence, that it lives to a great age, and that the utmost limits of its size are scarcely known; whence, in addition to well authenticated instances of some being twenty-five or thirty feet in length, others are reputed to attain the enormous dimensions of fifty feet. Though we are not enabled, from positive and conclusive evidence, either to corroborate or to controvert these facts, the observations of the naturalist already cited, throw considerable light upon the subject. Where animals live in a state of uninterrupted warfare, we are aware that there is little probability of their either attaining their extreme dimensions, or the utmost duration of life; and with respect to the latter, we are inclined to ascribe a much longer period to those that dwell in the waters than is usually allowed. The crocodile of the Nile, banished to the most southern parts of Egypt, is permitted to live undisturbed, and there it is universally admitted to increase to the largest size, far exceeding what is seen in other countries.

Were not the fecundity of the more powerful and destructive animals repressed, either by the attack of open enemies, or their own liability to perish, they would speedily overrun the earth. It is thus that almost all are confined within moderate bounds; that destruction is ever commensurate with multiplication, and sometimes by its preponderance entire species become extinct. Many animals have inhabited this island, of which there have only been fossil remains for ages; and an authentic record has preserved the period when the last of a noxious race was destroyed. In certain places, once infested by the crocodile, it is now totally extirpated, and in others its appearance is rare. In its earliest stage we have seen that it is liable to perish, either from being crushed to death by the female or devoured by the male. A species of tortoise frequenting the Nile, makes incredible havoc among the young. The hostility of the ichneumon has been related from times of remote antiquity; and though we cannot agree that it proves destructive of the crocodile itself, we at least know that it devours the eggs. In this manner, the numbers of so formi-

dable a creature, when less capable of defence, are diminished; but after having attained its utmost power, different means repress its voracity, and other enemies are on the watch for its destruction. Although the crocodile drags its prey under water to extinguish life, we have already remarked, that it must resort to shallows or the land to feed upon it; and in like manner, when attacked by the sword-fish or shark, it is easily vanquished, for on opening its mouth in resistance, a torrent of water rushes in, and it is drowned. Of all the enemies, however, which the crocodile has to dread, the most inveterate is man. By a perpetual and sanguinary war carried on against it in almost every country, and by the various devices adopted for its capture, the race is prodigiously reduced. But it is no easy matter to overcome an animal endowed with such uncommon strength, and whose hide in general is impenetrable by a leaden musket ball. It is, however, more vulnerable in the belly, and a bullet discharged down the throat or into the eyes is fatal. Even harpoons or spears will penetrate the body and inflict mortal wounds, if thrown by a skilful hand.

As the habits of the different species of true crocodiles do not vary much, except in so far as depends upon difference of size and strength, and difference of activity, which is always greater the warmer the climate, a mere enumeration of the remaining ones will be sufficient.

ST. DOMINGO CROCODILE (*Crocodilus acutus*). The muzzle of this species is longer in proportion than that of the former, more pointed at the extremity, but enlarged at the base. The scaly plates on the back are ranged in four lines, the lateral ones anterior and with very elevated crests. This species is exceedingly common in all the rivers and marshes of St. Domingo, and most of the other large West Indian islands. It has been confounded with the crocodile of the Nile, also with the caimans of the American continent, and its manners correspond exactly, though there are some differences in its external structure.

TWO-CRESTED CROCODILE (*Crocodilus bifurcatus*). This is the crocodile of the east, and is more abundant in the islands than on the main land of Asia. It has been seen as far to the southward as Timor, but it does not appear to have been hitherto found in Australia. It is reported, however, as being more discursive in the water than any of the other species, so that it has been met with a good way out at sea. It is browner than the Egyptian crocodile, and the dark spots upon it are more distinct.

Crocodiles have been observed in all the great rivers of Africa, and in the streams and marshes of the oriental islands, and also in the larger rivers of the extreme south of Asia, differing considerably from those now mentioned, although only in a few unimportant particulars. But the manners of the whole race, wherever they may occur, or however they may differ from each other in a few external particulars, are so much the same that, for popular purposes, any further account of them is unnecessary.

GAVIALS. The distinguishing characters of the gavials, at least in point of shape, are these: the muzzle slender and very much elongated; the teeth of nearly equal length, the fourth in the lower jaw passing into notches and not holes in the upper jaw; the hind feet are dentated on their external edges, and the webs reach to the roots of the claws; two large holes re-perforated in the cranial bone in the rear of the eyes,

which are perceptible through the skin. The most remarkable physiological character consists in these animals being much more aquatic than either the true crocodiles or the alligators. They repose on the mud in the shallows; but their food consists almost entirely of fishes, aquatic reptiles, and other living productions of the waters, seldom meddling with any warm-blooded creatures and never with man. There are only two known species, both of which are inhabitants of the south-eastern parts of the old continent.

GAVIAL OF THE GANGES (*Longirostra Gangetica*). This species appears to have been known to the ancients, who describe the Ganges as containing two sorts of crocodiles, one harmless and the other not. This species is of course the harmless one. The other species is the little gavial (*L. tenuirostra*), which is hardly known except as a museum specimen.

CROCUS (Linnæus). One of our commonest, earliest, and most favourite garden flowers. It belongs to the third class of the sexual system, and to the natural order *Irideæ*. The crocus is found wild in different parts of Europe, three of them in Britain, one of which is the cultivated saffron. The garden varieties are numerous, and all are very attractive. No flower is so sensible of the effects of light and heat as the crocus. Its petals expand during the day, and close at night. But they will expand at night under the light of a lamp or candle; or if placed within the influence of the heat of a fire, though shaded from the light of it, the petals open as readily as they do in bright light. The crocuses are mostly summer sleeping plants, particularly the spring flowering species; and when the spring growth ceases, the tubers are usually taken up and kept in a dry place till the early spring, when they are again planted where they are intended to flower.

CROSSANDRA (Salisbury). A splendid flowering evergreen shrub, found in India. Linnæan class and order *Didynamia Angiospermia*, and natural order *Acanthaceæ*. Generic character: calyx of five unequal parts, supported by three bractes; corolla salver-shaped, of one lip, which is large, flat, and five-lobed; stamens within the tube; anthers one-celled; capsule two-celled, two-valved; seeds netted. This genus is called *Harrachia*, by Jacquin, and *Ruellia*, by Andrews. The stove management of these plants is easy; they flower frequently, thrive in light rich soil, and are propagated by cuttings.

CROTALARIA (Linnæus). So called because the seeds of the genus rattle in the pods like *Krotalons*, or castanets. Many of the species are annuals and natives of warm climates. Linnæan class and order *Monadelphica Decandria*, and natural order *Leguminosæ*. Generic character: calyx two-lipped, five parted; vexillum or standard large, and reflexed; keel pointed; tube bearing the stamens; style downy; pod on a pedicel, oblong. The shrubby species of this genus have been long cultivated in our hothouses; they flower freely, and sometimes ripen seeds; but in default of these, cuttings may be rooted in sand under a glass in hotbed heat.

CROTALUS—Rattle-snake. A genus of ophidian reptiles, belonging to the poisonous division of the true serpents, and to that subdivision of them which have poison-fangs, unaccompanied by any other teeth. They are the typical serpents of this subdivision, and form a tribe, consisting of *Crotalus* properly so called, which have a rattle, or instrument of sound upon the tail; and *Trigonacephalus*, tri-

angular-headed serpents, which have not, but are fully as formidable as the others. With the viper family, which consists of more genera than this one, all poisonous, but of smaller size generally than the *Crotali*, and diffused over a greater variety of countries, these serpents make up the whole of the division.

It will be proper, therefore, to preface our brief notice of some of the more remarkable species of these formidable reptiles by a very brief sketch of the peculiarities which distinguish them from all the other serpents.

Their upper maxillary bones are very small, without any teeth, but having upon a long peduncle on each side, which answers to the external pterygoid process of the sphenoid bone, a very sharp tooth, which is perforated longitudinally by a canal, through which the deadly virus of the animal is injected into the wound made by the tooth. These two teeth are the poison-fangs of the animal; they are very sharp at the points, rather slender in proportion to their length, and awl-shaped, or adapted for inflicting punctured wounds only, and not for tearing or lacerating, so that the wounds which they inflict are not calculated to do much mechanical injury to their victims. Indeed, this addition would be quite superfluous, as the poison is of itself sufficient to kill almost any native animal of the places where these serpents are found; and it is a law of nature never to waste any power in the creatures which she produces, whatever may be the functions which they are called upon to perform. When the reptile is in a state of repose, these two deadly weapons are folded down into grooves in the gums; but when it is excited, they are erected, and their points so borne, that they are the first part of the reptile which strikes its prey. It is not the tooth which moves upon its peduncle; it is the maxillary bone which moves, and brings the fang into a proper position for wounding, at the same time that it has firmness enough for inflicting the wound. The virus is secreted by a gland of considerable size, situated on each side of the head, immediately under the eye; and the same muscular action which forces the tooth into the body of the prey compresses the reservoir of venom, and so forces it through the canal of the fang into the wound.

All venomous serpents are ovoviviparous, that is, the eggs are hatched internally, and the young brought forth alive; so that, whenever the eggs of a snake are met with in the ground, it may always be known that the snake is a harmless one. It is on this account that they have been called "vipers," which is a contraction of *vivipara*.

As the deadly virus with which these reptiles are armed, dreaded as it is, and fatal as it has proved in many cases, is nevertheless given to them for their own good, and not for the injury of other animals, excepting in so far as these serve as food to the reptiles, we might naturally suppose that both the *crotali* and the vipers must feed upon large game, that is to say, upon game which they would not be able to manage without these formidable weapons. Accordingly, we find that the mouths and gullets of all of them are capable of great extension.

The heads of these serpents are large backwards, so that there may be room for the apparatus which works their deadly fangs, and admit of the dilatation of their great gape. Their eyes are also fiery, and

they are altogether irascible in their aspect, and seem to partake all over of some of the deadly virus with which they are armed, and by the help of which they procure their food.

But we must not blame them for all this. Their peculiar structure, and the places in which they seek their food, do not enable them to strike it down like the birds of prey, nor to course it, or spring on it, like the predatory mammalia. We have also an example of the same sort of conduct in man, and we have it most remarkable in the very parts of the world where such creatures are most abundant. The poison with which the natives of the interior of Guiana, of southern Africa, of some of the Asiatic isles, and other places, prepare their darts and arrows, is almost literally man playing the crotalus, in that feebleness of his proper powers, or rather of the proper cultivation of them, which makes the savage stand to the civilised man in nearly the relation in which the serpent stands to the lion and the eagle. It must be admitted that civilised man, with his powder and shot, is not much better than the crotalus with its poison; and then there is this weight in the scale against him, that he discharges his stroke against his own species, and when the action is not to produce him a meal, which the reptile never does.

These poisonous serpents are not supplied with either the activity or the strength of the species which are not poisonous. Their movements are slow, and their dispositions tranquil, and they never appear to use their weapons unless when compelled thereto either by necessity or by fear. They are all inhabitants of the American continent; and some of them, though the winter is much colder than in the same parallel of Europe or Asia, are found much farther to the north than any serpent of nearly the same deadly venom is met with in the eastern continent. Those which are found far to the north (and, though they are not abundant, they are not altogether unknown in Canada) are abroad and dangerous only for part of the year, and remain in their holes in a torpid state while the severity of winter lasts; but in the tropical parts of the country they are never torpid, though they remain in hiding places, or are, at any rate, inactive during the rains.

The very high temperature of the summer months, even in those places of North America which are cold in the winter, and also the abundance of food, and of undisturbed caves for their residence, are no doubt the reasons why they are found in such northerly localities in that part of the world.

In the true *crotali* which have the rattle, or sounding apparatus, on the tail, there are considerable varieties, so that no specific character can be founded on the number of pieces of which this instrument consists. The pieces or bells consist of truncated pyramids and hollow collars, both of the nature of scales; and when the animal puts its tail in motion, these rattle against each other. As these do not contain any living part of the animal, but are mere appendages to the tail, the last ones are apt to drop off, just as is the case with the spine or claw which is sometimes found adhering to the skin of the lion's tail in the centre of the terminal brush. It does not appear that this rattle is of any use in the economy of the animal, or, which comes very much to the same thing, the use of it is not known. It cannot, as has sometimes been alleged, be of much use in warning other animals of the appearance or

presence of the serpent, and thus enabling them to make their escape, for the serpent must be one of very large size, and also very much excited, in order to be heard at the distance of four or five yards; and on the ordinary slow march of the animal it makes very little noise.

The smell of these serpents is exceedingly offensive, even when they are alive, arising, as is supposed, from the rapidity with which the flesh of those animals on which they feed putrefies from the action of the virus upon it. This virus is not a poison when taken into the stomach of other animals, and there is no reason to suppose that it is such when taken into the digestive organs of the reptiles themselves, while the effect to the bitten animal is a general putrefaction of the body, and we must suppose that this extends to the reptile also; and we have proof that it does, for the dead bodies of all the poisonous serpents putrefy very rapidly, and are exceedingly offensive to the smell during the process. Serpents which are not absolutely poisonous, but which swallow their prey entire, and in large quantities at a time, as is the case with the boas, pythons, and other great crushing serpents, have the same kind of smell, though it is not perhaps quite so offensive as that of the crotali.

Hence it should seem that there is a power of the decomposition of animal matter about all the true serpents, whether it is concentrated into a direct and local poisoning apparatus or not; and this great power of decomposition appears to be necessary for the animals, as they have not the means of separating the digestible parts of their food from the indigestible before it is taken into the stomach; neither do they appear to return any of the indigestible parts in castings, as is done by owls, and various other birds.

The crotali, and the other members of the subdivision, require the stimulus of the warmest climates and seasons to call forth their energies, and even the common state of the hottest countries does not, upon ordinary occasions, seem capable of rousing them to their full powers. It has been matter of observation, that they have more than common activity, and are more dangerous than ordinary, when the air is in a highly electric state.

This is less or more the case with all animals, and even with the human race, protected as they are from at least some of the vicissitudes of nature by artificial means; and it is very worthy of remark, that those serpents are the animals which are at once most strongly excited by the physiological circumstances of their own nature during the times they are in action, the most dependent upon high temperature for their activity, and the most energetic when most exposed to an electric state of the atmosphere. We have here the facts brought together in the instance of the very same creature, that the energy of life, the intensity of heat, and the excitement of electricity, increase and decrease together; and, if this is not proof that the three principles are one and the same, only differently modified, by being exerted through different combinations of matter, it proves to a demonstration that they are very closely related.

Serpents of this subdivision do not climb trees, neither do they move about with the flexible graces and waving motions of the harmless serpents. When they are on the march, they proceed in a straight course; and when they lie in wait for their prey, they all assume that position which is so well known under the name of the "adder's coil." Every one

who has seen a lurking adder, must be aware that the centre of this coil, or spiral, contains the head of the serpent, that the head is elevated to some length, in order to give the animal a view of whatever is around it, but that the greater part of the body is coiled level on the ground, and that it is the uncoiling of this spiral, acting very nearly in the same manner as the unbending of the spring of a watch, which gives them their impetus. If the enemy, or rather the prey, is of large size, they are worked into a corresponding degree of irritation; their eyes gleam—their cheeks are inflated—their lips are pulled tight—their large gape is opened to the full extent—their fangs are erected, ready to inflict the fatal bite, and their lengthened tongue is lolled out, as if in mockery of any defence which may be offered against that terrible poison with which they are armed.

But though upon the appearance of large prey, and especially of danger, they are excited apparently to madness, and their whole body quivers as if they themselves were under the influence of some terrible stimulus from without, yet there is method in their madness, and they will not spring upon any animal which they are unable to swallow, unless they are reduced to extremities by impending hostility; so that it will be found that the greater number of those who are bitten by these serpents, are either bitten in consequence of treading unawares upon them, or for making an unskilful attack. The most poisonous of them, if it sees a man or other large animal, when on its ordinary march, will get out of the way as fast as possible, and conceal itself in the nearest cover; but if it is coiled, and waiting for prey, and especially if its prey is in sight, it cannot be expected to quit its position without showing resentment; for there are few domestic animals which, when hungry, suffer themselves tamely to be driven from their food.

Birds which feed on the ground, various reptiles, squirrels, rats, and, generally speaking, all mammalia not larger than hares (according to the size of the individual serpent), form the common prey of the crotali. As they are no climbers, and as their motions on the ground are so slow and so much in the straight line that they would have little chance of capturing any prey by pursuing it, they necessarily have recourse to springing from the coil; and, in so far as animals of different classes can be compared, they bear no inconsiderable resemblance to the cat family, only these spring from the crouch, while the poisonous serpents spring from the coil. But it is worthy of remark, that the more powerful cats which spring upon large prey, invariably work themselves into a state of great excitement before they throw themselves upon their prey; and it is not less worthy of remark, that the cat family are remarkable for the excitability of electric action in them; and it is probable that it is an instinctive effort to lessen the annoyance of atmospheric electricity, which induces the common cat to wet its fur, or wash its face as it is usually expressed, in electric states of the air.

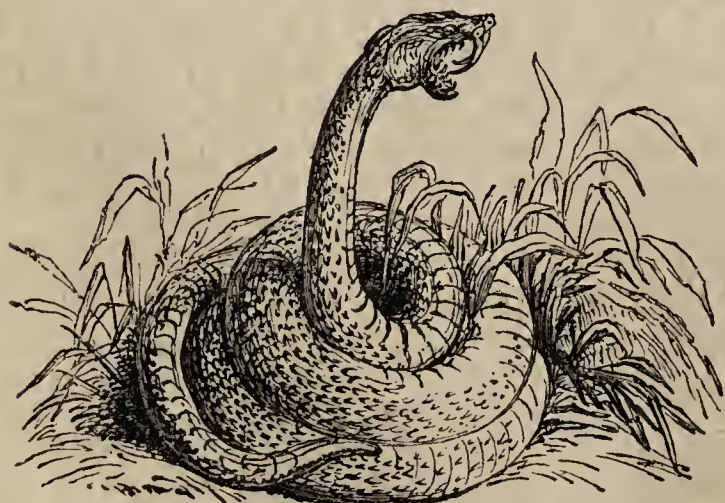
The power of fascination which these serpents have over their smaller prey, has been so often mentioned, as to leave little doubt that it is in a great measure true; and they are not the only animals which, upon sight of their mortal enemies, are rendered quite helpless by excess of fear. That they themselves can be charmed by musical sounds seems also to be established upon pretty good authority; and for this also there are precedents among the other animals; indeed

there is perhaps no animal but which may be turned from its momentary instinctive impulse, and brought to simple attention by one combination of sounds or another; and it will readily be understood that if once this is done, the former impulse of the animal is gone for ever, and cannot return without a return of those circumstances which, according to the general nature of the animal, give rise to that particular impulse.

This is a most important point in animal physiology, and one which ought never to be lost sight of; and it explains many circumstances connected with the conduct and apparent characters of animals which otherwise would be perfectly anomalous. Upon this principle very many of those marvellous stories which are told of animals leaving their natural instincts, and sparing that which it is constitutional for them to devour, which have often been attempted to be explained by something approaching to human sagacity, to grateful memory, or to both in the animals, can be much better explained as arising from the fact of the animal having no speculative sagacity and no suggestive memory at all, but as being mere creatures of the moment, incapable of drawing inferences from the past, and of forming plans for the future. The fascination of their prey by serpents, and the charming of serpents themselves by human art, of both of which, as we have said, there is no reason to doubt, at least to a very considerable extent, evidently arise from the withdrawal of the animal's senses from its object; and keeping them bewildered; and as it requires a much greater effort to work one of those poisonous serpents up to the proper pitch of attacking, than it does most other animals, it is easy to see that if it is once withdrawn from its purpose, it cannot so easily return to it, but must require the same time, and the same train of excitement as before. Perhaps we may have occasion to enlarge a little upon this very curious subject in an article FASCINATION.

From the difficulty, and also the danger of observing these creatures in their native haunts, the genera and species are in a very unsettled state, and it would be foreign to our purpose to attempt an adjustment of them, even though we were in possession of the means; we shall therefore merely mention one or two of the leading ones, remarking that, if the rattle is to be considered as a generic distinction, some other name should be invented for the whole family of the poisonous serpents of America, which are, generally speaking, of much larger size than those of the east, and also more deadly in their virus. In the meantime we may consider them all as *crotali*.

BUSH MASTER. This species is perhaps the most for-



Bush-master.

midable in point of size and also in deadliness of bite.

It is found in the humid thickets of the woods of Guiana, and does little harm when left at peace; but it is a very formidable creature when attacked. The preceding figure of it in the act of starting from its coil, will give some general idea of the form and bearing of all the family. This one attains the length of five or six feet; and in those large specimens the poison fangs are nearly an inch and an half in length, very sharp, and thus capable of inflicting a mortal wound in a very large animal, from the depth at which they can discharge the virus.

COMMON RATTLE SNAKE (*Crotalus horridus*). This is the more northerly species. It was formerly found six or seven feet long; but it has been so much hunted since the colonisation of North America, that it is not now met with of so large size. It is not dangerous to man or domestic animals, unless attacked, or trod upon accidentally; and the smell of it is so offensive to most animals, as to make them avoid the bushes in which it is lying hid: pigs are the only animals which venture to invade their retreats; for the olfactory nerves of the pig are not only proof against all sorts of smells, but the peculiar nature of his skin and the lard under it is such, that the fangs even of a rattle snake are innocuous to the animal who gobbles up the serpent as a *bonne bouche* wherever he can find it.

The remaining species, with the exception of the small spotted crotalus, which is found in the arid plains to the westward of the Mississippi, and so southward into Mexico, and the yellow serpent of the West India Islands, are not so clearly made out as to warrant our giving a popular account of them under their specific names, as these have been framed from museum specimens, with very little knowledge of what the animals are in wild nature, and sometimes in ignorance of the part of the world of which they are natives. Indeed it has sometimes happened that a serpent has been given to very nearly the antipodes of his native locality; thus, as we had occasion to mention in the article COLUBER, an American serpent has been described in the systems as the Esculapian serpent of the ancient Greeks; and by way of making matters worse, even some of the crotali have been represented as coming from Ceylon.

There is much to be learned before the history of reptiles, even in Britain, shall be worthy the name of a science, or rather a scrap of a science, for the reptiles in our islands are so few; and therefore when we consider the vast extent of the localities of tropical serpents, the obscurity of their manners, and the apprehensions that most people have of them, we almost despair of seeing for many centuries anything like even a tolerable system of this singular branch of living nature,—a branch which, from its intimate connection with the most fertile spots, and the greatest energy both of animal and of vegetable life, would doubtless, if rightly understood, furnish one of the best keys to those general operations of nature, which stamp their most prominent characters upon the different regions of the world. For one or two general observations we must refer the reader to the articles OPHIDIA and REPTILE.

CROTON (Linnæus). A tropical genus of shrubs so called, because the seeds resemble ticks. Linnæan class and order *Monœcia Monadelphica*, and natural order *Euphorbiaceæ*. Generic character: male flowers, calyx five-parted; petals five, with glands between each; stamens numerous; filaments free and awl-

shaped; anthers oblong and erect; female flowers, calyx of five parts; petals none; styles three, twice or many-clefted; seed-vessel three-berried. The greater number of these plants are uncultivated; one, the *C. tinctoria*, is cultivated in the south of Europe for the dyer. Those kept in our stoves are admired for their variegated leaves; of which the late Mr. Sweet mentions a curious circumstance, namely, that unless the plants are grown in "a mixture of pure peat earth and sand, the leaves will soon become green, and lose all their variegation."

CROTOPHAGA—Ani. A genus of omnivorous zygodactylic birds, natives of the tropical parts of America, of which the characters are: the bill short, thick, arched, and with a trenchant ridge on the culmen compressed laterally, angular at the sides, and without any notch; nostrils lateral, near the base of the bill, oval, and open; feet long and strong, the tarsi a little longer than the outer toe; wings short, the first, second, and third quills gradually increasing, the fourth and fifth the longest in the wing; and the tail long, rounded, and composed of eight large and strong feathers.

From this form of the wings and tail, it might be inferred that these are not birds of long flight, neither do they prey upon the wing. They have some of the structural characters of our magpie, but the feet are formed for more habitual perching. They are, however, much more social birds than the magpies, and have none of the crafty and suspicious manners of these cunning birds. They are social birds, and are always found in small flocks; but they prefer the open plains, and perch on the tops of bushes, or often upon elevated hillocks. They are familiar, and not afraid to perch on the backs of cattle when grazing, in order to pick off the insects with which these are often very much infested in warm countries. Their voice is not very musical, and it has been compared to the sound of steam issuing boiling from a kettle; but, like the sound of the rook, it is better in concert than solo, and it is in concert that it is generally heard, as it is rare to meet with one of the genus single, and as rare to hear one cry without its being instantly joined by another.

Though the companies of these birds which are seen together are not so numerous as those of the rooks, yet they are even more social than these, the most social of all our omnivorous birds. Rooks build in the same tree, but this genus breeds in the very same nest, and old and young may be seen enlarging the nest when the latter are to begin the cares of a family. The nest is substantially made in the large fork of a close bush or tree; the materials are dry twigs, interlaced and lined with fine vegetable fibres. The sides are well raised, and the diameter of the structure is often a foot and a half. The eggs are three or four in number, of a dull greenish colour; and from the community of the nest, it must often happen that the eggs of different mothers are mixed during the incubation. Still that does not disturb the amity of these very social birds. They feed upon maize, rice, and other different sorts of grain, and upon fruits, as well as upon insects and their larvæ, and worms.

There are two species: *C. major*, about the size of a jay, and *C. minor*, about the size of a blackbird. The plumage of both is black, with some reflections of purple and green.

CROWEA (Smith). A genus of shrubs from New South Wales, named in honour of J. Crowe,

a celebrated botanist of Norwich. Linnæan class and order *Decandria Monogynia*, and natural order *Rutaceæ*. Generic character: calyx five-cleft; petals five, oval, spreading; stamens inserted under the disk, bearing the germen; filaments flat; anthers two-celled, united to the interior sides of the filaments; style almost none; stigma fleshy and somewhat lobed; disk fleshy, bearing the germen; capsule containing five single seeds. This is a favourite greenhouse plant, as it flowers throughout the greater part of the year. It cannot bear over-watering, and requires plenty of free-air. It is propagated by cuttings.

CROWFOOT, is the *Ranunculus acris* of Linnæus, and the butter-cup of the British meadows. It is a very prevalent weed in grass land, in consequence of the flower stem not being relished by cattle, so that the seeds are annually shed where they grow. To extirpate them is a tedious labour, as each individual plant must be rooted out with a forked spud. It is said that if eaten by cows it gives a bitter flavour to butter, but this requires confirmation.

CRUCIANELLA. See **CROSSWORT**.

CRUCIFERÆ—Cruciferous family. A natural order of dicotyledonous or exogenous plants, containing ninety-eight known genera, and nearly one thousand species. It is a very natural family, and is allied to *Capparidææ*, *Papaveraceæ*, and *Fumariaceæ*, from which orders, however, it is at once distinguished by its tetradynamous stamens. Its essential characters are: sepals four, deciduous, two often gibbous at the base; petals four, in the form of a cross (hence the name cruciferous), alternate with the sepals; stamens six, of which two are shorter, solitary, and opposite to the lateral sepals, while four are larger, in pairs, alternating with them; ovary superior, two-celled; style single; stigmas two, opposite the placentæ; green glands at the base of the germen and stamens; fruit a siliqua, or silicula, two, rarely one-celled, two-valved, the valves separating from the placentæ, rarely valveless, one or many seeded; seeds attached in a single row by a funiculus to each side of the placentæ, generally pendulous, and without albumen; embryo with the radicle folded upon the cotyledons.

The plants belonging to this order are herbs, which are annual, biennial, or perennial, rarely suffruticose. Their leaves are alternate, and their flowers are usually yellow or white, and grow in corymbs or racemes. They grow in greatest abundance in Europe, nearly one hundred and twenty species being found in the northern and middle European countries, and one hundred and eighty on the northern shores and the islands of the Mediterranean. Numerous species are also met with in Asia Minor, Persia, the northern coast of Africa, Siberia, India, New Holland, and North and South America. Besides species whose locality is not well known, or which are common to different countries, we have about one hundred in the southern, and eight hundred in the northern hemisphere. In the temperate zone the number of species amount to six or seven hundred, in the frigid to above two hundred, while within the tropics little more than thirty have been detected. The *Cruciferæ* are included in the class *Tetradynamia*, the fifteenth of the Linnæan, or artificial system. This class is well characterised by having four long stamens and two short. It is divided into two orders first, *Siliculosa*, in which the fruit is a roundish pod

or pouch, as is seen in *Honesty*, *Shepherd's Purse*, &c.; second, *Siliquosa*, in which the fruit is a very long pod, as is seen in wallflower, gilliflower, &c. Decandolle and others have divided the order into sections, according to the mode in which the cotyledons are plaited or folded, and the position of the radicle in relation to them. The following are the sections founded on these characters:—

I. *Pleurorhizææ*, in which the cotyledons are flat, with the radicle lying upon their edges, as in the genera *Mathiola*, stock; *Cheiranthus*, wall-flower; *Nasturtium*, cress; *Barbarea*, *Arabis*, *Cardamine*; *Lunaria*, honesty; *Alyssum*, rocket; *Draba*, *Cochlearia*, *Thlaspi*, *Iberis*, candytuft, &c.

II. *Notorhizææ*, in which the cotyledons are flat, with the radicle lying on their back, as is seen in the genera *Hesperis*, dame's-violet; *Sisymbrium*, *Erysimum*, *Camelina*, *Senebiera*, *Lepidium*, *Isatis*, &c.

III. *Orthoploceææ*, in which the cotyledons are folded lengthwise, as in *Brassica*, cabbage; *Sinapis*, mustard; *Diplotaxis*, *Vella*; *Crambe*, sea-kale; *Raphanus*, radish, &c.

IV. *Spirolobeææ*, in which the cotyledons are coiled up spirally, as in *Bunias* and *Erucaria*.

V. *Dipleclobeææ*, in which the cotyledons are bent double, as in *Helioophila*, *Subularia*, and *Brachycarpææ*.

This is a most extensive order, including many of our valuable esculent vegetables, such as cabbage, raddish, sea-kale, and cress, and some articles of materia medica, as mustard and scurvy grass. In it too we find some plants used in the arts, such as woad, and others which are cultivated in gardens on account of their beauty, such as stock, gilliflower, wallflower, candytuft, rocket, &c. In general cruciferous plants are antiscorbutic, stimulating, and acrid. The pungent taste and powerful odour which many of them possess are owing to the presence of a volatile oil, which is easily procured by distillation. The properties of the plants vary according to the quantity of this oil which enters into their composition. When by cultivation the plants are made to contain a large quantity of mucilage and water, their acrimony is either altogether destroyed or much diminished, and they become agreeable articles of food. A similar effect is produced by blanching.

Cruciferous plants contain sulphur and nitrogen in their composition, and during the process of decay give out an ammoniacal odour, similar to that evolved from animal substances. In consequence of the nitrogen which they furnish, the plants of this order have been used in place of the horns and hoofs of animals in the manufacture of Prussian blue. Their seeds abound in a fixed oil, which is often expressed and put to important uses.

In their botanical, medical, and chemical characters, the cruciferæ exhibit such an analogy and uniformity that it is needless to dwell long on the individual genera and species. We shall notice a few of the most interesting. The genus *Sinapis* furnishes several important species. *Sinapis nigra*, common mustard, is found under hedges and in waste places in many parts of Britain. Its seeds furnish the mustard of our tables. They are very acrid and stimulating, and when reduced to powder and mixed with vinegar and crumb of bread, they form rubefacient cataplasms known by the name of sinapisms. When applied externally these are useful in causing a rapid determination of blood to the surface of the body, and in rousing the energy of the circulation. If kept applied

for a considerable time they will even produce inflammation and vesication. The powder or flour of mustard is sometimes administered as an emetic in the dose of a dessert spoonful. It has been given successfully in cases of cholera and gout, and in intoxication threatening apoplexy. The seeds of mustard, according to chemical analysis, yield a fixed and a volatile oil, vegetable albumen, mucilage, sulphur, nitrogen or azote, sulphate and phosphate of lime, and silica. The fixed oil is bland and insipid, and is obtained by expression. The cake which is left contains all the acrimony of the mustard. This acrimony is owing to the presence of the volatile oil, which is procured by distillation. *Sinapis alba*, white mustard, is frequent in waste places in Britain, and is well distinguished by the long beak which terminates its pods. Its seeds are whiter and more mucilaginous, less acrid, and not so large as those of the last species. They were formerly employed to stimulate and strengthen the tone of the stomach. In a young state the plant is eaten under the name of mustard along with cresses.

The seeds of *Sinapis Chinensis* are considered by the Hindoo and Mahometan practitioners as stimulant, stomachic, and laxative. *Sinapis arvensis*, wild mustard or charlock, is one of the most common weeds in corn fields.

O'er the young corn the *charlock* throws a shade,
And clasping tares cling round the sickly blade.

The next genus we shall notice is *Nasturtium* or water-cress. *Nasturtium officinale*, formerly *Sisymbrium nasturtium*, common water-cress, is a perennial plant frequent in all the brooks and rivulets of this country. Its leaves remain green during the whole year, but are in the greatest perfection in spring. They have an acrid taste and a somewhat pungent smell when bruised. By drying or boiling they lose their sensible qualities entirely. When fresh they are extensively used as an excellent and wholesome salad. Since 1808 this plant has been much cultivated in the neighbourhood of London. Large plantations of it exist at Uxbridge, Gravesend, in Hertfordshire, and other parts of England. It has also been raised in the vicinity of Edinburgh and Paris. In its cultivation a constant supply of running water is required. The expressed juice contains the pungency and slight bitterness of the plant, and has been prescribed in doses of an ounce or two as a gentle stimulant and diuretic. It enters as an ingredient into antiscorbutic syrups and wines.

Cardamine pratensis, common meadow lady's smock, is abundant in moist meadows, where it is rendered conspicuous by its large blush-coloured flowers, which are sometimes double. It is used in the same way as the water-cress. It was formerly looked upon as a diuretic, and given in doses of one or two drachms twice or thrice a day. It has sometimes been recommended in nervous diseases, such as epilepsy.

Sisymbrium officinale, formerly *Erysimum officinale*, common hedge-mustard, is another indigeneous plant found in waste places and by way sides every where. The leaves of this plant do not possess the pungency of those of the other cruciferous plants. They are slightly acid, and are employed as tonics. The herb is used by singers to cure hoarseness and strengthen the larynx.

Brassica oleracea, sea-cabbage, is the origin of the common garden cabbage, of which there are nume-

rous varieties, such as, cavalier cabbage, Savoy cabbage, Brussels sprouts, early dwarf cabbage, sugar loaf cabbage, red cabbage, cauliflower, and broccoli, &c. (See articles BROCCOLI, CABBAGE, and CAULIFLOWER.) Cabbage was formerly employed as a remedy in diseases, but is now confined entirely to domestic uses. In Germany it is made to undergo a degree of fermentation, and forms what has been denominated *Sauer Kraut* or *Chou-croûte*. The red variety of cabbage is sweet and mucilaginous. It is used for pickles, and has been prescribed in chronic inflammations of the respiratory organs.

Brassica napus, rape or cole seed, is cultivated on account of the oil produced by its seeds, which, after being pressed, are made into cakes, and are used as manure, or for feeding cattle. The oil is used for lamps and domestic purposes.

Brassica campestris, grows spontaneously in the fields all over Europe, and is also extensively cultivated. There are several varieties of this species, among which may be mentioned the *rutabaga*, or Swedish turnip.

Brassica Rapa supplies the common turnip, so abundantly cultivated both in gardens and in fields.

Raphanus sativus, common radish, was originally a native of China and southern Asia, but has now become naturalised all over Europe. There are sixteen or twenty varieties known to gardeners. Some of these have globular turnip-like roots, and a rose or white colour externally, others have elongated, spindle-shaped roots, while a third set are known by their black and wrinkled exterior, and their extremely pungent taste. The latter are denominated black or Spanish radishes.

Sepidium latifolium, broad-leaved pepper-wort, has a hot acrid taste, and produces a redness of the skin when applied to it. It is a powerful antiscorbutic.

Lepidium sativum, common cress, is a well known salad. The seeds are sometimes made to germinate on cloth or wool moistened with water, or a solution of chlorine, and kept in a moderate temperature.

Lepidium oleraceum grows in New Zealand, and is prized there as a remedy for sea-scurvy. It resembles lettuce in taste, and acts as a moderate aperient.

Lepidium piscidium is used by the natives of the Society Islands, for the purpose of catching fish by inebriating them.

Cochlearia officinalis, common scurvy-grass, is abundant on the sea shore, as well as on elevated mountains in Britain. Its leaves yield a heavy volatile oil, one drop of which dissolved in alcohol is sufficient to communicate the odour and taste of the plant to a pound of wine. The plant, as its name implies, is antiscorbutic.

The roots of *Cochlearia armoracia*, common horse-radish, have a pungent flavour, and are used as a condiment to roast beef. They are prescribed medicinally to promote the flow of saliva, and have been recommended in cases of palsy of the tongue. An infusion of them in cold milk forms a safe cosmetic.

Crambe maritima, sea kale, is a native of the sea coast in several parts of Britain, and is frequently cultivated in gardens. When blanched it is esteemed as a culinary vegetable.

Isatis tinctoria, dyers' wood, is scarcely indigenous in Britain. It is cultivated on account of the dye, which is produced from its leaves, and which is used as a substitute for indigo. In consequence of the cheapness of the latter, the cultivation of woad is no

longer profitable. The ancient Britons used this plant to paint their bodies of a blue colour.

Camelina sativa, gold of pleasure, is cultivated in Germany, on account of the oil which it yields.

The seeds of *Erysimum cheiranthoides* are used by country people to destroy worms.

The dried root of *Dentaria diphylla* is used by the Americans instead of mustard, under the name of pepper root.

Barbarea Quæcoæ, early winter cress, is the American or Belleisle cress of gardeners.

Without dwelling longer on this extensive family, and attempting to notice all the species which are prized in the kitchen or the flower garden, we think that we have already sufficiently illustrated its properties, and shown its importance and value among the other vegetable tribes.

CRUSTACEA. One of the three primary divisions or classes into which articulated animals provided with articulated legs, are divided. They are distinguished by having the head generally confounded with the thorax, and respiring by branchiæ or gills placed at the sides of the body, beneath the hard covering or shell in which they are encased. The larger and better known species are those marine animals known under the ordinary name of shell-fish, and in the Linnæan system they composed two genera alone in the apterous order of insects, namely, *Cancer* and *Monoculus*. They are a group of animals hitherto but little attended to, either as regards their structure or habits, although several observers stand out in opposition to this observation. Thus Aristotle devoted a chapter to their history, in which much fabulous matter is of course introduced; and in the time of Hippocrates, a certain number of them were known as useful in medicine. Rondeletius, Belon, and Gesner, &c. published various descriptions of them, illustrated by rude figures; but it is to Swammerdam, Willis, and Roesel, that we are indebted for the first attempts to illustrate their organisation. Brisson, perceiving the impropriety of allowing these animals to remain amongst the true insects, first separated them, forming them—together with the *Myriapoda* and *Arachnida*—into a class intermediate between fishes and insects, thus taking the first step towards a natural distribution of the articulated animals. Fabricius and Latreille, by accumulating many valuable materials relative to them, assisted greatly towards the same end, but it is to the immortal Cuvier that we are indebted for the first separation of the *Crustacea* as a class within its strict limits.

Since this period Lamarck and Leach, as well as Latreille, occupied themselves in an especial manner towards the elucidation of this class, and formed its contents into various natural groups. Jurine, Straus, Shaw, &c., by their microscopic investigations, have greatly assisted in diffusing a knowledge of the smaller animals, whilst Savigny, Audouin, and Milne Edwards, have studied with great success the oral and internal anatomy of the *Crustacea*. In our own country the recent observations of Drs. Johnstone and Fleming, and the beautiful work of Mr. J. V. Thompson, have shown that the subject is not neglected amongst us; and very lately another observer has entered the field, S. Hailstone, junr., esq., whose descriptions of various species found on the southern coasts of England, published in the Magazine of Natural History for May, 1835, prove him to be no indifferent naturalist.

The *Crustacea*, regarded under the different relations exhibited by their organisation, ought unquestionably to occupy an elevated range in the annulose sub-kingdom. They ought not, indeed, to be far removed from the *Arachnida* and insects, which, like themselves, have a symmetrical body encased in a hard corneous covering, performing the offices of an external skeleton, and with articulated legs, eyes always apparent, sexes distinct, &c. They are, however, evidently much farther removed from the *Annelida*, in which the body is destitute of true articulated limbs, the eyes wanting, and the generation often hermaphrodite. These last, indeed, in many respects inferior both to the *Crustacea* and *Insecta*, seem to be more nearly allied to the intestinal worms, and *Epizozozoa*. With respect again to the fishes with which they are vulgarly associated, their relations are very trifling indeed*; but with the mollusca, especially such as the *Cephalopoda*, there is much greater affinity, so that they might naturally be placed after them in the series of animals; but as we find other mollusca, such as the *Gasteropoda* and *Acephala*, still less perfectly organised, we should either be compelled to introduce the *Crustacea*, in the midst of them, or to place the mollusca either after the entire group of annulose animals, as the ancients did, or before the *Crustacea*, as the more recent zoologists have done; and this latter step is confirmed by the observations of Latreille, who has proved the existence of the great affinity between certain of the least perfectly organised fishes, and the most perfectly organised mollusca, as the *Cephalopoda*.

The following are the characters by which the animals of this class are distinguished from the other annulosa. Animals destitute of internal vertebræ having white blood; the body divided into various segments (differing in number), encased in a crustaceous envelope, and provided with articulated legs, respiring by means of branchiæ or branchial plates, ordinarily annexed to the base of the legs or lower jaws, having a distinct heart, furnished with visible vessels, with legs, of which the number is generally five or seven pairs, and always destitute of wings; head generally confounded with the thorax, furnished with two pairs of antennæ, and a pair of mandibles (often palpi-gerous); two pairs of lower jaws, and three pairs of foot-jaws (the two posterior pairs of which are transformed into two additional pairs of legs, when there are seven pairs of the latter organs); mouth also furnished with an upper and lower lip, or rather a tongue; the external pair of foot-jaws (see figure of the underside of the body of *Carcinus mænas*, vol. i. p. 722,) performing the office of a lower lip; eyes two, faceted, often borne upon footstalks; sexes distinct; sexual organs placed either at the base of the legs or the extremity of the body.

The class which we are now considering may be considered as taking the place in the ocean which insects occupy on land. They are very varied in their forms, as well as size, some of them being in fact the giants of the sub-kingdom to which they belong, whilst others are of a microscopic minuteness. Some species are of a globular or oval shape, others square, whilst

a few are linear and elongated, some again have the body quite flat, others are compressed, and in a few the covering of the body, instead of being hard and crustaceous, exists in a softened and membranaceous state.

These animals possess the ordinary senses which the inferior animals are gifted with, although, from the great modification in their structure, as compared with that of the vertebrated higher animals, it is difficult, and, indeed, often impossible for us to assign them to their legitimate organs. That they taste is evident from the fact that they are not indifferent to the kind of food which they meet with, and which, indeed, they seek with much assiduity. The very complex organisation of their mouths, the development of which far surpasses that of insects, must doubtless be regarded as affording the seat of this sense. The organs of sight are very distinct, in the greater number existing as faceted eyes, borne upon footstalks, often of a very great length, as in *Podophthalmus*; often, however, they are sessile, that is, not elevated upon the surface of the head or shell. The structure of the eyes of these animals has lately been studied very minutely by M. Muller (Ann. Sc. Nat., July 1829). The sense of touch, from the hard envelope in which these animals are encased, must in all probability be greatly diminished, especially in the more crustaceous species.—The circumstance that they are provided with two pairs of antennæ, as well as several pairs of palpi attached to the jaws and foot-jaws, seems to favour the opinion that this sense is transmitted by means of these organs. The sense of hearing has not been distinctly proved to be possessed by these animals; it has, however, been supposed that the seat of this sense was placed in an excavation observed at the base of the external pair of antennæ in certain of the larger species, as the lobster, &c., in which cavity it has been stated, that a small sac filled with fluid exists, in the midst of which a nervous thread was fixed; it is certain, however, that the aperture of this cavity is closed by a membrane, and that in some cases there exists (as in *Maia*) a small crustaceous organ or moveable operculum, the use of which appears to be to distend the membrane which shuts the orifice. Of the distinct existence of the sense of smell we are also equally ignorant, although from analogy we are led to believe that it is possessed by these animals. Its seat is also unknown, although Rosenthals and Robineau considered that it existed in a pair of small orifices at the base of the internal pair of antennæ.

Annulose animals having the vertebræ as it were external, are necessarily prevented from undergoing a similar mode of growth to that which distinguishes those animals which, having the vertebræ internal, acquire an increase of the external softer portion of the body, without any obstacle to its addition; but the solid shell of the crab may readily be conceived to be an unsurmountable obstacle to its growth, which nevertheless takes place from year to year. Nature, therefore, has removed this obstacle in a curious manner. The caterpillar casts its skin several times before it becomes a chrysalis, the crab in like manner undergoes an annual moulting; but it may well be conceived that the complete shedding of a crustaceous envelope like that of the crab, must be a far more remarkable operation than the slipping of a thin membranous skin like that of a caterpillar. The principle is, nevertheless, the same in both cases. When, however, we consider that not only the shell but also

* A celebrated zoologist recently requested a friend who was going a long sea-voyage, to bring him home all the fishes he could procure. "Yes," was the reply, "I will catch you all kinds, from a whale to a shrimp;" neither of which, as every person acquainted with the slightest outlines of zoology well knows, are fishes.—We mention this anecdote to show that a little knowledge here would not have been a dangerous thing.

the covering of all the most delicate organs, such as the eyes, antennæ, and even branchiæ is shed at the same time, we find not less grounds for astonishment and wonder. The minute *Crustacea*, whose growth is very rapid, change their coats at very short intervals of time. Thus Jurine observed that the young *Daphniæ* moulted eight times in seventeen days, but amongst the large species, such as the crabs and lobsters, this only occurs once a year. When, therefore, at the end of the spring, the *Crustacea* having previously obtained such an increased supply of food, as to make their shells too confined for the increased size of their internal organs, they cast their entire skeleton as we may term it. Previous to doing this, they appear sick, languid and restless, seeking some secluded place, in which they may securely remain until their new covering shall have attained a sufficient consistence. In casting their shells it is difficult, at first sight, to conceive how it is possible that the enclosed claw, for instance, can be so completely drawn out of the old covering, through the narrow part by which it is attached to the body, so as to leave the shell of the claw entire, and attached to the exuvia of the body, in which state they are constantly found. The new shell, however, is at first quite soft and membranaceous, so that we may thereby account for this circumstance, without adopting the opinion of the fisherman, that the lobster pines so much before moulting, that the flesh of its large claw is reduced to the size of a goose quill, which enables, it to draw its parts through the joints and narrow passage next the body. Still it is evident, that the forcing of the inclosed claw, even if ever so soft, through so narrow a passage must be exceedingly painful. It is to Reaumur that we are indebted for our knowledge of the precise circumstances connected with this curious phenomenon, that distinguished author having imprisoned several crayfish about to moult in pots pierced with holes placed in running water. It is said that it is easy to perceive when the period of moulting is approaching, by pressing the backs of the animals, when the shells yields readily to the pressure of the finger, not offering that resistance which is common to them. The animals then beat their legs with violence against each other, the body is in a complete agitation, the membranes between the segments being greatly distended, so that the shell is raised considerably from the abdomen, the membrane bursting which connects them. By degrees the entire shell and external covering is shed, and in the course of two or three days, or even twenty-four hours, the new skin has acquired its proper consistence.

Another circumstance of a still more remarkable nature, occurs in the animals we are now treating upon, namely, the reproduction of the claws and legs when accidentally broken off. In some species, indeed, the limbs are so slightly attached, that the least touch causes them to shed them. In like manner it is said that lobsters fear thunder, and are apt to cast their claws on a great clap, and that they will do the same on the firing of cannon; so that when men of war meet a lobster boat, a jocular threat is used, that if the master does not sell good lobsters they will salute him. In the course of a day or two the naked skin exposed by the wound, is found to be covered with a reddish pellicle, which soon assumes a convex surface, grows longer, becomes conical, increases in size, and splitting, exposes to view a soft body, composed of the same number of parts as had been lost.

This soon gains the consistence of the remainder of the body, but never acquires the size of the limb lost although at every subsequent moulting of the skin, its size increases more rapidly than that of the rest of the limbs.

This curious phenomenon involves, in a singular manner, the principles upon which the moulting of the skin of the annulosa takes place. We are taught that the wings of a butterfly exist in the caterpillar state, and that the legs of the larva of a grasshopper envelope the legs of the perfect insect; if, therefore, we admit the theory of Swammerdam, founded upon these statements,—that every larva at its first exclusion, contains within itself the germ of the future imago and of all its envelopes, which, successively presenting themselves, are thrown off, presenting to view the next internal envelope, we shall be compelled to establish another theory for the *Crustacea*, similar to that of Dr. Heroldt—that the successive skins of the larva, pupa case, imago, and its parts and organs, do not pre-exist as germs, but are formed successively from the rete mucosum. Reaumur has, indeed, attempted to explain the causes of this re-production of limbs; inquiring, if, at the base of each leg, there may not be a provision of new legs, as in children there is a tooth under the milk tooth! We are surprised that so acute a reasoner as Reaumur should not have perceived the incorrectness of such a supposition. It is perfectly natural that the milk teeth are one day destined to fall, and it is natural that their places should be occupied by fresh teeth, which are accordingly provided. But it is perfectly unnatural—merely accidental—that the lobster should lose its claws; and it is equally unnatural to suppose, that nature should have provided a series of organs which, in the majority of instances, would be totally useless, depending only upon accident for their casual development.

The female crustacea, after impregnation, deposit a vast number of eggs, which, in many instances, are retained beneath the abdominal portion of the body, whilst in some, as in the opossum shrimps (*Mysis*), the sea wood-lice (*Isopoda*), they are retained in a kind of sub-thoracic pouch, and in others they are placed in a membranaceous bag, or pair of bags, dependent from the base of the abdomen, as in the *Cyclops*, *Branchipus*, &c. It has been generally stated in all works upon this class, that with a very few exceptions, the young, when hatched from the eggs, closely resemble their parents in form; these exceptions occurring in *Cyclops*, the young of which were regarded by Muller as belonging to two distinct genera (*Amymone* and *Nauplius*), *Argulus*, and *Branchipus*. Indeed, Dr. Leach, one of the chief investigators of this tribe of animals, has assigned it as one of their principal characters, that they undergo no metamorphosis. Mr. J. V. Thomson of Cork has, however, lately published a series of memoirs, in which he has announced as an “important discovery,” that the greater number of the crustacea do actually undergo transformations. The circumstance of the crustacea being supposed to pass through no intermediate form, has been brought forward heretofore as one of the arguments for their separation from insects; but although the fallacy of that opinion may diminish the number of characteristics which distinguish these two tribes of animals as distinct classes, there yet remains those depending on the anatomical structure of their respiratory and circulating systems, which are

quite sufficient to render their separation permanent. It may also be observed that the changes presented to our notice in the crustacea, are quite peculiar, and of a totally different description from those of insects." Mr. Thomson then proceeds to notice the different extraordinary animals known to naturalists under the name of zoea, which, from their peculiar structure, had greatly perplexed systematic crustaceologists, and states, "It will no longer be a matter of surprise that all the leading naturalists of the present day should have been at a loss how to dispose of zoea in their arrangements of the crustacea, when it is known that this singular type is not a perfect animal, but merely the larva or imperfect state of the crab! and not as had been imagined an animal *sui generis*." Subsequently our author states, amongst other circumstances, that he, "succeeding in hatching the ova of the common crab, during the month of June, which presented exactly the appearances of *Zoea Taurus*, with the addition of lateral spines to the corselet, the crustacea then indisputably undergo a metamorphosis, a fact which will form an epoch in the history of this generally neglected tribe, and tend to create an interest which may operate favourably in directing more of the attention of naturalists towards them*." And as the zoeas are aquatic animals furnished with swimming organs, Mr. Thompson concludes that the circumstance of the young of the crustacea being thus natatory, enables us satisfactorily to account for the annual migration of the land crabs of the West Indies to deposit their eggs in the water. We have thus given Mr. Thompson's observations at some length, because the facts, if fully established, are highly interesting, and sufficient to raise Mr. Thompson to a very high rank amongst naturalists. It is proper, however, to state, that Dr. Rathke has, in a series of microscopic observations, far more elaborate than any hitherto published by Mr. Thompson, clearly shown the gradual development of the cray-fish within the egg, and which, upon bursting into life, possesses all the form of its parent, whilst the Rev. Lansdown Guilding has expressly stated that the land crabs do not undergo any metamorphosis (Mag. Nat. Hist., May, 1835), a statement which we can fully confirm; thus, two examples in the great divisions of *Brachyura* and *Macroura* are shown to militate against Mr. Thompson's assertion, that the crustacea universally undergo metamorphosis; and, as the organisation of those two animals is so completely analogous to that of the common crab (the young of which Mr. Thompson affirms to be a zoea) and the rest of the *Decapoda*, we think that analogy strictly warrants us in assuming that Mr. Thompson must have fallen into some fundamental error in his observations. We look forward, with great interest, to his promised continuation of these memoirs, which have been too much neglected by naturalists.

Various modes of distribution of this class have been proposed by different crustaceologists, which it would occupy too much space to detail; we shall, therefore, proceed to give a short sketch of that which appears to us to be the most natural hitherto published, namely, that by Latreille in the second edition of the Règne Animal, premising only that we have omitted the fossil tribe of *Trilobites*, which will form a distinct article, and that the distribution of Mr. Edwards, founded primarily upon the manduca-

tory or suctorial nature of the mouth, appears to us to be less natural than that given below.

CLASS CRUSTACEA.

Section 1. MALACOSTRACA. Shell of a solid consistence; legs ten or fourteen; mouth with a labrum, two mandibles, four maxillæ, six or ten (according to the number of legs) foot jaws.

Sub-section 1. PODOPHTHALMA. Eyes on footstalks.

Order 1. *Decapoda*. Legs ten; foot jaws ten; branchiæ in a cavity at the sides of the thorax; divisible into two sub-orders.

Brachyura (short tailed crabs—See BRACHYURA).
Macroura (lobsters, &c.—See BRACHYURA and MACROURA).

Order 2. *Stomapoda*. Branchiæ not inclosed beneath the shell at the sides of the thorax; legs more than ten.

Sub-section 2. EDRIOPHTHALMA. Eyes not elevated on footstalks.

Order 3. *Amphipoda*. Body compressed; mandibles palpigerous. See AMPHIPODA.

Order 4. *Læmodipoda*. Abdomen rudimental, with only the rudiments of one or two pairs of appendages. See CAPRELLA.

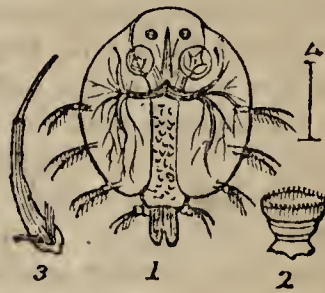
Order 5. *Isopoda*. Body depressed; abdominal appendages flat and plate like; mandibles not palpigerous.

Section 2. ENTOMOSTRACA. Shell not solid; legs variable in number; mouth very variable.

Order 6. *Branchiopoda*. See this article and its divisions.

Order 7. *Pæcilopoda*. Mouth suctorial, or destitute of mandibles and maxillæ, but defended by the ambulatory legs which perform this office. Divisible into the sub-orders *Xiphosura* (or king crabs), and the *Siphonostoma* (or fish parasites). See CALIGIDES.

As these kinds of tabular sketches are best elucidated by references to figures, we will direct our readers for an illustration of the *Decapod Brachyura* to Vol. I. p. 722, for a figure of *Carcinus mænas*; of the *Decapod Macroura*, to p. 167 of this volume, for a figure of the *Cray-fish*; of the *Amphipoda*, to Vol. I. p. 95, for a figure of *Gammarus Palix*, by mistake called *Pernys*, which is the *Corophium longicorne*; of the *Læmodipoda*, to Vol. I. p. 691, for a figure of *Caprella Phasma*; of the *Isopoda*, to Vol. II. p. 25, fig. 2, representing *Armadillo vulgaris*; of the *Branchiopoda*, to Vol. I. p. 626, representing the *Brine Shrimp*; and we here figure the *Argulus foliaceus*,



1, the animal magnified; 2, one of the large anterior sucking feet; 3, the rostrum; 4, natural length.

belonging to the order *Pæcilopoda* (sub-order *Siphonostoma*), an account of the habits of which will be found under the article CALIGIDES. The remaining classes *Stomapoda* and *Xiphosura*, will be illustrated in subsequent articles.

CRYPTANDRA (Smith). A genus of curious shrubs from New Holland. Class and order *Pentandria Monogynia*, and natural order *Rhamneæ*.

* Zoological Illustrations, p. 9.

Generic character: calyx of five sepals; corolla tubular, five-cleft, in the throat of which there are five hollow scales concealing the stamens; stigma trifid; capsule three-valved, seeds three. These plants were introduced into our collections twelve years ago; and thrive well in the greenhouse, potted in loam and moor earth. They are propagated by cuttings without difficulty.

CRYPTODIBRANCHIATA (De Blainville; CEPHALOPODA, Lamarck, Cuvier; SEPIA, Linnæus). These molluscs form the first order of the modern system of Malacology—or that science which treats of soft bodied animals, without bones or articulations; some, however, possessing internal testaceous portions, and by far the greater number external shells or coverings, varying in an infinite degree of form; the intermediate links of affinity between these singularly organised creatures, mark those interesting changes which take place throughout the system, many of them to be satisfactorily proved by analogous reasoning, to be the consequence of necessity arising from peculiarity of circumstance or situation.

This order of molluscous animals, as far as is yet known of them, includes species of the type, possessing the highest and most perfect organised parts and faculties of all the mollusca; they enjoy all the animal functions of seeing well, hearing, moving with ease and rapidity from one spot to another, of pursuing and seizing their prey; and they even appear to possess something like a feeling of attachment to each other. It having been remarked by an accurate observer of nature, whose observations we have frequently been permitted to quote, on these animals and molluscs in general, that he has remarked and repeatedly made the experiment of placing other molluscs with members of the *Cephalopoda*, and always found they were driven from their society, and obliged to congregate in a different part of the same space to which they were confined; observing also, that when one of these intruders presented itself, or had wandered out of its assigned limits, the *Common Cuttle fish* particularly, exhibited, as it were, immediate signs of uneasiness. That peculiar breathing kind of motion, which resembles the exhaustion and filling of their bladder-formed bodies, became more rapid; their tentacular appendages much agitated; and, in a few seconds, the whole of the family were in motion, occupied in driving the stranger from amongst them, all united as it were in a common cause against the supposed enemy. Their movements, however, upon this occasion were by no means rapid; on the contrary, they seemed guided by a regularity of purpose generally understood to themselves, and it might almost be imagined directed by a recognised commander—they never assailed the intruder, each after his own fashion surrounding it promiscuously, but clearing a passage, left ample space for retreat; and then, from the nearest to the most distant point, they closed in and prevented its intrusion. In this movement much purpose was exhibited, for the *Sepiæ* did not form themselves into a solid mass, but each of them appearing to have a place allotted to it, moved nearer to the sphere of action, with something like regularity; each one prepared and in motion, but not going far from the spot in which it had been reposing: the impulse of alarm appeared general, but rather to excite caution than anger, though the result invariably was the same, that of precluding the stranger from entering into their congregation. These observations were made on a

part of the Dutch coast, where some acres of marsh land were overflowed each tide; and the situation being, doubtless, favourable to these creatures, their numbers were countless—the whole space exhibiting a palpitating moving mass of creatures, in some parts so closely packed as to have the appearance of forming but one animal. Professor Kops, of Amsterdam, visited the spot in the summer of 1816; and his interesting remarks on this occurrence form a paper read at an academic meeting in Holland. The following year, however, the same spot was deserted, and not a single scpia to be seen there.

The body of the animals of this order are enveloped and partly free, in a very thick mantle, expanding into a wide opening at its anterior side; the edges free, and detached all round, looking like a sack or opened bladder, without any trace of muscular abdominal disc, or of a foot; this body is most generally naked, either unprovided with solid internal parts, or inclosing a shell or other hard substance; sometimes provided with an external substance or testaceous portion, covering or sheathed in the body. This is never composed of two opposite valves, its shape is extremely various; it is placed dorsally, and serves as a shield or protection to some of the more delicate organs. The animal is completely inarticulate, provided with a very large head, more or less projecting; this presents four or five pairs of conical tentacular appendages attached at their base to a kind of skull which envelops the brain, and are furnished with suckers used for prehension: these arms are disposed in a circular order, in the form of a coronet. The mouth is altogether anterior, elongated or tubular; armed with a large pair of horny teeth in the form of a parrot's beak, acting vertically against each other. The mantle is diversified; the gills or organs of respiration various; rarely symmetrical, lateral, and concealed in the sac; the circulation is double, one particular, the other general; the heart unilocular, sometimes with the auricles divided, and very distant; no medullary cord along the body, but provided with a few scattered nerves and ganglions.

This order includes the genera *Octopus* in the first family, and the second family *Decacera*, contains the *Loligo* and *Sepia*. They are abundantly found in the seas of all countries, and probably larger and more numerous in those of warm latitudes, where marvellous stories are related of their gigantic structure; they, however, are so much involved in ignorance and mystery, resting only on the uncorroborated testimony of incompetent judges, that though we are not in a position to contradict them positively, we are unwilling to receive them as well-established facts. Not that we absolutely reject the possibility of much we have heard respecting them being true, for every instant of our existence brings to light new discoveries in the animal kingdom, elucidating the phenomena of nature; and we have constantly had occasion to remark, that marvellous as many of the tales of olden times at first appeared, they more or less have originated in a simple matter of fact, distorted or magnified by subsequent narrators, and disguised at all times by ignorant credulity, which eagerly adopts that which cannot easily be disproved. We are, however, as we have just stated, cautious without being incredulous; never forgetting that Bruce's *Abyssinian beefsteaks* drove him from society, and broke his heart by slow degrees. We have also the assertion before our eyes of a recent delightful writer, who says he is really

fearful that his truth would be doubted if he were to relate some of the scenes he had witnessed ; and he has actually confided his information to such only as know his integrity, leaving future travellers to confirm his assertions. We can fully appreciate this feeling, and honour it ; but were all mankind to be actuated by similar delicacy, no progress would be made in elucidating the phenomena of nature—science must cease to advance, and ignorance become perpetuated. First impressions are readily received, and frequently remain deeply impressed, but a well constituted mind hesitates to admit them, without having minutely weighed the mass of evidence for or against them, and exercising a sound discretion as to its worth.

It would be travelling far out of our prescribed path, to enumerate the thousand instances we might easily adduce, in which a description of nature and her operations would be treated at first sight as the idle dream of a disturbed imagination, or a tale of poetic fancy. This applies to every portion of creation, but to none more universally than to *entomology* ; in which the insect transformations, their habits, and their ordained purposes, have become additional proofs of omnipotent wisdom, through the laborious investigations of a host of eloquent writers on the subject, from an early period, down to those of the venerable Kirby and others of our own time. With such examples, we dare not reject any thing as impossible to the Architect of nature ; but we are slow to give implicit credence to all we hear, unsupported by the clearest concurring testimony.

Cephalopoda—the name given to these animals by Lamarck, Cuvier, and other modern naturalists—is derived from two Greek words, implying the feet so called, being placed on the head. *Cryptodibranchiata* means the animal's two branchiæ being concealed. *Cephalopod* is, however, the commonly received term, and is more expressive, as indicating a character which readily strikes the senses, without requiring any additional information from anatomical examination, to guide the first step towards a system of classification.

CRYPTOCEPHALUS (Geoffroy). A genus of coleopterous insects of considerable extent, belonging to the family *CHRYSOMELIDÆ*, which see, having the antennæ long and slender, head small and vertical, the body short, thick, and cylindric, and legs formed for walking. They are of a small size, seldom reaching half an inch in length. Their form is not elegant, but they are compensated by the beautiful colours and markings with which they are adorned. They are found upon flowers in the hot sunshine, and feed, both in the larva and perfect state, upon vegetable matters ; destroying the young buds, they do not cut, but macerate, and occasion them to dry up and fall. When disturbed they have recourse to artifice by folding their antennæ and legs close to the body, and counterfeiting death. At a late meeting of the Entomological Society of France a larva found in an ants' nest, enclosed in a solid case, was described, and which was considered to be that of a species of this genus. M. Génè of Turin has also published some interesting observations upon the larvæ of the *Cryptocephalus*. Dejean, fourteen years ago, enumerated seventy species, since which the number has greatly increased. There are about twenty inhabitants of this country, amongst which the type, *Chrysomela sericea* of Linnæus, is one of the prettiest species, being of a fine silky golden green colour with black

antennæ ; it is about one-third of an inch long, and is found upon umbelliferous plants in June.

CRYPTOSTEGIA (R. Brown) is an East Indian genus belonging to *Pentandria Digynia*, and to the natural order *Apocynææ*, according to Sweet and Sprengel, but to *Asclepiadeæ*, according to Lindley. The *C. grandiflora* is a beautiful climber, and thrives well in the common mixture of loam and moor earth, and may be propagated by cuttings struck in sand.

CRYPTOSTEMMA (R. Brown). A genus of syngenesious annuals from the Cape of Good Hope, and belonging to the natural order *Compositæ*. The species require to be treated like tender annuals, that is sown on a gentle hot-bed, and, when strong enough, planted out in the open borders in May. They are handsome flowers, and deserve to be in every flower garden.

CRYPTOSTOMA (Leach). A mollusc whose body is tongue-shaped, in a great degree formed by a very long and thick foot, narrower in front, channelled on both sides, and extending considerably beyond the twisted visceral mass, which is very small, rather convex on the upper side, and about a third of it covered with an internal shell extremely similar in every respect to the *Sigaretus* properly so called ; the mouth is very small and concealed beneath the anterior and superior fold of the foot, towards which its four grooves diverge ; from this very singular position of the mouth the genus has been named. There are two tentacula pedunculated at their base, eyes not ascertained, and one great branchial comb. There are only two species of this genus described, both from India, but it is not improbable some species of Lamarck's genus *Sigaretus* will be discovered to belong to it. It is placed in the second class *Para-cephalophora*, second order *Chismobranchiata*, family *Limacinea*.

CRYPTOSTYLIS (R. Brown). A genus of New Holland gynandrious plants introduced into this country about ten years since. Like other *Orchidæ*, the flowers are curiously shaped, and of a dark brown colour. The bulbs or rather tubers are connected in a bundle, and thrive best planted in a frame, or, according to Mr. Sweet, on a warm border, where, if they are only protected from frost in winter, they will survive and flower finely. Their favourite soil is turfy moor earth, loam, and sand.

CTENISTES (Reichenbach). A very minute genus of coleopterous insects belonging to the family *Pselaphidæ*, having the palpi as long as the head, with the extremity of the second, third, and fourth joints armed laterally with an acute spine. They are nearly allied to *Bryaxis*.

CTENOPHORA (Meigen). A handsome genus of dipterous insects belonging to the section *Nemocera* and family *Tipulidæ* or crane flies, distinguished by having the antennæ beautifully feathered in the males ; these organs moreover are thirteen-jointed in both sexes. In other respects they are very nearly allied to the daddy-long-legs, or true tipula. They are found in damp situations, amongst herbage, &c. The larvæ resemble those of the *Tipulæ*, and live in the decaying matter of trees, &c., where they change into pupæ, having the body armed with hooks. There are eight British species, the type being the *Tipula pectinicornis*, Linnæus.

CUCKOO (*Cuculus*, auctorum). A most interesting genus of zygodactylous or yoke-footed birds, or of those which have the toes situate two before and two

behind. This, however, by the way, although very generally accepted, is by no means a satisfactory division, as it contains a great variety of birds which have otherwise very little or no resemblance: the cuckoos, the parrots, the woodpeckers, and the toucans, together with several other very dissimilar forms, are here brought together and included in one order, which have hardly a single character in common; and even the foot, which forms the sole basis of the classification, is extremely different in many of the genera, as a comparison of this organ in the woodpeckers and parrots will abundantly show. It has been commonly designated a *climbing* foot, but in some of the families it is never used in this manner; and, in the birds which we are now about to describe, the chief purpose of this conformation appears to be, to give additional firmness to the grasp, the centre of pressure being, in the cuckoos, exceedingly forward.

In this genus the bill is somewhat compressed, of moderate length, or about as long as the head, and slightly curved, the lower mandible following the curve of the upper; the nostrils are basal, round, and margined with a prominent and naked membrane; the gape of the mouth is very wide, but the gullet is small, in the common species not large enough to admit the finger. The wings are of mean length, pointed, having the first quill-feather short, and the third longest; tail rather long, always more or less wedge-shaped, and strongly fortified by coverts. The tibiae are clothed with long feathers, as in many of the diurnal birds of prey; the tarsi short and feathered a little below the joint; the two front toes are joined together at the base, and the two hinder ones entirely divided, the outer hind toe being partly reversible. The character of the plumage is firm, and they carry an immense deal of feather in proportion to their size, and the hues of the more typical species are, in general, rather sombre, mostly ash-colour or dusky on the upper parts and breast, with the under parts lighter and barred across; in the immature state they incline more to rufous, and are everywhere transversely barred with a darker colour; this latter being also the mature plumage of one or two of them. A few small species, however, from the Cape, nearly allied in some respects to the former, have the upper parts of the most brilliant emerald green, these being among the most truly splendid of the feathered race.

The true cuckoo to which the typical appellation *Cuculus* is now restricted, are all natives of the eastern continent, but America produces species very closely allied in structure to these, which we shall have occasion to mention as we proceed, but which differ too essentially in their general economy to be included in the same generic division. One of these, the *Coccyzus Carolinensis*, having been driven out of its regular line of migration, and winged its way across the wide Atlantic, has now occurred several times during the autumn months in this country, and has consequently found its way, as an accidental straggler, into the long catalogue of species which occur in the British islands.

The common European cuckoo (*Cuculus canorus*, or *singing* cuckoo) is a bird about the size of a small pigeon, or rather appearing of that size from the very great quantity of feathers with which it is clothed. Its bill is blackish brown, yellowish at the base; the corners of the mouth and the rim around its eyes bright orange; the irides gamboge yellow; gape orange red. Its head, neck, breast, and upper parts

are of a deep bluish grey, darkest upon the wing-coverts. The whole of the belly, thighs, and under tail-coverts whitish, with transverse black bars. Inner webs of the quill-feathers with oval white spots. Tail black, with a few white oblong spots along the shafts of the feathers, which are also tipped with white. Legs and feet lemon yellow.



The Common Cuckoo.

The above is the adult livery of the male bird; and the mature female differs only in being always more or less marked upon the breast and sides of the neck with rufous bars, somewhat similar to those of the young.

The well known vernal call note of this species, its

“Note of fear,
Unpleasing to a married ear,”

is generally first heard in the south of England about the second week in April, sooner or later, however, in some measure according to the temperature of the season; for, if the weather continue cold and bleak, though the birds have made their appearance, their note is but very seldom repeated. This call note is, indeed, at all times very much affected by the state of the weather; during a long continuance of drought it gradually becomes more and more hoarse, till, at length, it seems to be uttered with considerable effort, and the first syllable of it is often broken into two or three; but no sooner does the wind veer to a rainy quarter, than, before even a change is visible in the sky, it immediately softens, and is pronounced quite musically and distinct. We are at present in some doubt as to whether this cry—*cuckoo*, is common to both sexes; but the writer of this article inclines rather to assume the contrary, at least, till it can be positively shown, from the examination of a female that had been heard to sing, that this really is the case: generally speaking, he is pretty confident that the hen bird does not utter the note.

There is, however, another cry, which certainly is repeated by both sexes, though most frequently by the female cuckoo; it may be expressed by the sound *cul* or *cuil*, repeated several times in rapid and continuous succession, and it is invariably uttered either when the bird is upon a tree, generally the moment before it takes wing or immediately after, sometimes the one and sometimes the other; this note very closely resembles one or two passages in the nightingale's song, and we may always calculate upon seeing the bird flying immediately after hearing it. The other and more generally known note—*cuckoo*, is alike repeated either when the bird is perched or

as it flies across a field; sometimes, also, during the night. Some sound and accurate observations upon this species are contained in the following unsophisticated doggrel; they apply, however, only to the adult cuckoo, for the young of the year do not leave us till the month of September.

“ In April,
Come he will;
In May,
He sings all day;
In June,
He changes his tune;
In July,
Off he'll fly;
But in August,
Go he must.”

The alteration of the note in June is, as we have already stated, entirely dependent upon the weather, which, at least in the south of England, where the rhymes are current, is usually very hot and dry during the month of June. Quaint and homely little sayings such as these, simple as they may at first sight appear, are often great aids to the memory, and have mostly been put together by persons of much observation and discernment. Those who study practically natural history, have very often occasion to admire and commend their accuracy.

The most curious, wonderful, and extraordinary circumstance in the natural history of this bird, and that upon which all its other peculiarities depend, is the strange, and at present quite unaccountable habit which it exhibits, of invariably depositing its eggs in the nest of some other species, at no time, nor under any circumstance whatever, constructing a nest and hatching its own eggs like other birds; the same is also said (and is probable) of the other typical species of *Cuculus*, but at present this requires some confirmation. The American and other *Coccyzi*, which, except in having rather a stronger bill, and in being a little longer in the tarsus, approximate very closely to the true cuckoos in their general structure, build nests and tend their progeny like the other feathered tribes around them. The only decided and well authenticated instance of a similar deviation from ordinary rule, occurs in the cattle-bird or cow-bunting (*Malothrus pecoris*, Swainson) of North America, a bird of the starling family, and of which a rather detailed account (chiefly taken from Wilson's American Ornithology) has already been given in its alphabetical situation in this work. That species, however, from its abundance and much greater familiarity, is easily enough studied, and its various peculiarities are all much more satisfactorily elicited than are those of the European cuckoo. The latter is one of the very shyest of the shy; its history has been much obscured by scribblers, and we are a great deal indebted to chance observers for the facts that have been brought together concerning it.

Like the American cattle-bird, the European cuckoo (as indeed might be anticipated) does not pair, nor, according to the common acceptance of the term, is it a polygamous species, but all of them live together in a promiscuous state of concubinage. Tied down by no duties of incubation, they are perhaps bound to no particular spot, but wander without control throughout the summer. This the naturalist of Selborne alludes to in one of his poetic effusions—

“ And listen to the *vagrant* cuckoo's tale.”

Yet, though it be undoubtedly difficult in places

where cuckoos are abundant to identify any particular individual, unless, indeed, it be an albino, or otherwise conspicuously distinguishable, we are inclined to think from repeated observation, that each cuckoo does generally confine itself within a certain range. The male probably locates himself in a particular situation in a spot congenial to his habits, where food is to be obtained plentifully; and if a sufficient number of the other sex there answer to his call, he probably does not wander far from the place. We have arrived at this conclusion, from having observed always a certain number of these birds in a particular spot. The female cuckoo, however, may probably sometimes wander a considerable distance when searching for a suitable nest to deposit her egg in.

Strangely enough, the number of eggs which the cuckoo lays in the course of a season, has never been very satisfactorily determined; which might easily enough be done, by dissecting a sufficient number of females during the spring and summer months.

“ It is possible,” says Montagu, “ that some may lay two lots of eggs during their stay with us, but then we have reason to believe there is a considerable space of time between the first and second lot. In two or three females, dissected at the time they first began to lay, we could only discover four or five eggs that could possibly be laid successively; from the smallest of which, to what may be termed the secondary eggs, there was a sudden break off, not a gradual decrease of size.” A young cuckoo of the preceding year (known by not having entirely thrown off its nestling feathers), which the writer of this examined on the twenty-second of May, contained in the ovary three largely developed eggs, which unquestionably would have been laid on the following consecutive days; there were also sixteen or eighteen others (besides a multitude of small ones) enlarged to the size of mustard seeds, but a competent physiologist* is of opinion, that these would not have been laid the same season, their increase of size being occasioned by the determination of blood to the parts; they presented no vascular appearance, and it is probable that, after the breeding season, they would have diminished to their former minuteness†.

The cuckoo's egg is remarkably small for the size of the bird, hardly equalling in this respect that of the skylark; it is therefore somewhat in proportion to the small nests into which it is commonly introduced. Those parts, also, *quæ maribus tribuuntur*, are at all times most disproportionately small in this species, even less than in the common sparrow; but whether this has any connexion with the size of the egg is difficult to determine. The American *coccyzi*, according to Wilson, have the egg “ proportionable to the size of the bird,” and it would therefore perhaps be worth while to notice further the internal structure of the males of these. The egg of the common cuckoo is usually of a very oval form, of a reddish white, thickly sprinkled over and blotched with rufous and darker brown spots, which are rather more numerous at the larger end; like most other eggs, however, it is subject to some variation.

Contrary to the usual opinion, the female cuckoo appears to deposit her egg into the first suitable nest she happens to find, whatever may be the species of bird to which it belongs, whether granivorous or (like

* W. Yarrell, Esq.

† The ovary in question is now preserved in spirits.

herself) insectivorous; and it is one of the most curious facts in natural history, that many of the smaller finches, which never themselves touch any sort of insect food, and even bring up their own young exclusively upon softened vegetable food ejected from their own craws, will, notwithstanding, rear up the young cuckoo upon caterpillars and other insects. A case is mentioned in the "Magazine of Natural History," of a young cuckoo being brought up by a pair of common linnets; and another, in which a pair of green grosbeaks were the foster parents. In the "Field Naturalist's Magazine," also, for January, 1834, the following highly interesting fact, bearing on this subject, is recorded.—"A cuckoo was found just feathered, in the nest of a hedge-chanter. It was immediately taken from thence, and placed in a cage containing a hen canary. The birds agreed perfectly well; but what is most singular, when the proper food for the cuckoo (small caterpillars, &c.) was placed in the cage, the canary fed its young charge with that, although she herself kept to the hempseed, &c., to which she had been accustomed." It would appear, however, from the results of a great number of experiments which the writer of this has instituted upon this subject, and in which, from the great difficulty of procuring a number of cuckoo's eggs, those of the skylark were chiefly employed, as being both in colour and size somewhat similar to them, that an alien egg, surreptitiously introduced into a nest, is very frequently ejected from it by the rightful owners. The writer of this has tried this experiment upon a very great number of species; has placed the alien egg along with other eggs, has taken the latter away and substituted it singly in their place, and has placed it in many newly-finished nests, before any other eggs had been deposited in them, and he has continually observed the same result. He thinks, therefore, he may fairly conclude that the cuckoo's egg also is very frequently turned out by the birds into whose nests it is deposited. He can only thus account for the excessive rarity of its occurrence, although the birds are everywhere seen abundantly, and though he has counted upwards of fifty eggs, of different sizes, in the ovarium of a single cuckoo.

It is indeed stated by Mr. Hoy of Norfolk, a gentleman well known to naturalists as a most accurate and close observer, that "it appears to be usual for the birds, in whose nests the cuckoo may have deposited an egg before they may themselves have begun to lay, to cast out the cuckoo's egg;" and as that gentleman has bestowed particular attention upon the phenomena of this interesting bird, he has doubtless observed some instances to warrant this remark. He mentions, however, one case in which the contrary was observed. "On one occasion," he says, "I had observed a cuckoo during *several days* anxiously watching a pair of wagtails building; I saw the cuckoo fly from the nest two or three times before it was half completed; and at last the labour of the wagtails not going on, I imagine, so rapidly as might be wished, the cuckoo deposited its egg before the lining of the nest was finished. The egg, contrary to my expectation, was not thrown out; and on the following day the wagtail commenced laying, and as usual the intruder was hatched at the same time with the rest, and soon had the whole nest to itself." This instance seems to favour the opinion that the cuckoo possesses the power of retaining her egg in the oviduct considerably longer than is the case with birds in gene-

ral; and it is possible, as has been suggested to the writer of this article by a distinguished physiologist, that the nervous excitement of the bird, whilst wanting to lay, may have the effect of preventing the immediate development of the egg next in succession. There is not the slightest reason, however, to suppose with some that the egg is ever quickened in the oviduct by the heat of the parent bird; for were such ever the case, it would of course be necessary that it should be deposited in a nest upon which the owner had begun to sit, which the cuckoo of course would be unable to do, as she never drives a bird off its nest, but sneaks into it during its absence. It is hardly necessary perhaps here to remark, that after the vital action within an egg has once commenced, a very short suspension of the necessary degree of warmth is sufficient to destroy the embryo. No instance, however, has been yet recorded of the cuckoo's egg having been found addled.

The common cuckoo's egg has been known to occur in the nests of the following British species, viz., the blackbird, songthrush, skylark, green grosbeak, linnet, chaffinch, hedge-chanter, different pipits and wagtails, yellow and reed bunting, redstart, robin, reed warbler, hedge warbler, and grasshopper warbler; but in at least nine cases out of ten, it is found either in those of the common or the shore pipit (*Anthus pratensis* and *A. obscurus*), or in that of the pied water-wagtail (*Motacilla domestica*, *M. alba* of Linnæus), and somewhat less frequently in that of the hedge-chanter (*Accentor modularis*); the chief reason of which, in the opinion of the writer of this, is that these birds are not so much in the habit of turning out an alien egg as the others are; he has known, however, the hedge-chanter to eject a lark's egg that was placed along with its own, and also to eject another which was placed alone in the nest, its own eggs having been taken away. Some birds, as the blackcap, most usually forsake a nest into which the egg of another species had been introduced. Others will turn out the alien egg, and even then desert their nest.

Nothing is more certain than that the number of cuckoos' eggs that are found is out of all proportion small, considering the number of birds that are heard and seen. Unlike all other birds also, the number of young cuckoos that are ever seen in autumn is very considerably smaller than that of the old ones; although, from their being very much buffeted and persecuted by swallows and many other small birds, they are little likely to escape observation. It is, therefore, very difficult to conceive how the species is continued so abundantly; perhaps they live a great number of years, but the following fact seems hardly to warrant this supposition, that there is not, when they arrive in spring, the same proportion of individuals of the preceding year that we find in other birds. The writer has noticed that the greater number of cuckoos, which he has examined in spring, were birds of the preceding season, these always having a remnant of the immature plumage upon the wings, two or three of the quill-feathers, and of the greater coverts impending over them, not having been shed; but it is possible that these are more frequently shot, from their being less suspicious and vigilant than the old birds.

We do not think it very probable that, as some persons have imagined, the cuckoo's egg is ever suffered to perish, from the bird not having been success-

ful in finding a suitable nest in which to place it. Judging from past experience in the way of birds' nesting, we should think this almost impossible, more especially as the cuckoo's season for laying is when birds' nests are found in greatest abundance; and penetrating as she does into the very midst of thickets and furze-brakes, we may fairly give the cuckoo credit for being a much better hand at finding them than we are. Although the writer of this has never actually known an instance of the cuckoo's egg being ejected, he has no doubt whatever of this being the sole cause of its extreme scarcity.

A very favourite resting-place of this species is upon an isolated tree, which commands a wide prospect around; and, in such situations, the female cuckoo, concealed amid the thickest foliage she can find, sits quietly and observes the operations of the numerous smaller birds around her; more particularly noticing those which are carrying about building materials, and marking the place of deposit; this, also, is probably another reason why the cuckoo's egg should most frequently be found in the nests of ground building birds.—“A pair of wagtails,” says Mr. Hoy, “fixed their nest, early in April, among the ivy which covers one side of my house, and reared and took off their young. A few days after the young birds had left the nest, I observed the old birds apparently collecting materials for building, and was much amused at seeing the young running after the parent birds, with imploring looks and gestures, demanding food; but the old birds, with roots or pieces of grass in their bills, seemed quite heedless of them, and intent on their new habitation. Their motions were narrowly watched by a female cuckoo, which I saw constantly near the place; but the wagtails had placed their second nest within a yard of the door, and so well concealed among some luxuriant ivy, that the cuckoo, being often frightened away, was not able to discover the nest. The intruder being thus thwarted in its design, the birds hatched their second brood, which was accidentally destroyed a few days after. In about ten days they actually commenced a third nest within a few feet of the situation of the second, in safety. I have repeatedly taken the cuckoo's eggs from the wagtail's nest; in this locality, it has a decided preference to it. I do not recollect finding it in any other, excepting in two instances, once in the hedge-chanter's and another time in the redstart's nest. In this vicinity, whether the wagtail selects the hole of a pollard tree, a cleft in the wall, or a projecting ledge under a bridge, it does not often escape the prying eye of the cuckoo; as, in all these situations, I have frequently found either egg or young.” Sometimes, however, the cuckoo is obliged to wander about a little to find a nest; the writer of this has noticed one, probably when wanting to lay, to hover slowly along the hedges, penetrating into every thick bush, and examining every likely place to find a bird's nest: upon such occasions the cuckoo, no doubt, deposits its egg in the first nest it can find.

One or two cases have been mentioned, but we think they much require corroboration, of the egg of this species having been found in situations where it could not possibly have been *laid*; that is to say, in domed nests, and others that were so situate that the cuckoo could not possibly have crept into the place, but must consequently have introduced its egg either by means of the bill or foot. We are very much in want, however, of a new and well authenticated in-

stance of this; for, in the cases which have been mentioned, it is by no means impossible that the egg had been surreptitiously introduced; many school-boys, indeed, would be greatly delighted to think that they had so puzzled a philosopher. In all the instances which have fallen under the observation of the writer, and in all that he has ever heard of, from direct observers (which together amount to a very considerable number), the nest was without exception so situate that the cuckoo could have laid its egg into it.

Mr. Hoy relates the following fact: “I once observed a cuckoo enter a wagtail's nest, which I had noticed before to contain one egg; in a few minutes the cuckoo crept from the hole and was flying away with something in its beak, which proved to be the egg of the wag-tail, which it dropped on my firing a gun at it. On examining the nest, the cuckoo had only made an exchange, leaving its own egg for the one taken.” It invariably, when undisturbed, destroys whatever other eggs there may be in the nest into which it deposits its own, though this fact has not been noticed by writers on the subject. Whatever other eggs, therefore, may be found in the same nest with that of the cuckoo, were not laid, in most instances, till after its deposition. Of this the writer has the most abundant and satisfactory evidence; he has repeatedly known the cuckoo's egg to have been found alone in different nests, and he has been informed by a direct observer, of the following fact: a meadow pipit's nest was found with four eggs in it, which, on being looked at a day or two afterwards, was observed to contain a solitary cuckoo's egg, all the others having disappeared. On searching about the place the broken shells of them were, however, found at a short distance. Another instance was made known to him by a birds'-nesting boy, of whom he purchased the cuckoo's egg. This lad found a meadow pipit's nest with two eggs in it, and going the next day to look at it, these had both disappeared, and that of a cuckoo was in their place alone; the following day the pipit laid an egg to this, and the day after that another, when the nest was taken from the place. A further proof of this fact may be deduced from the circumstance, that whenever eggs are found in the same nest with that of the cuckoo, they are almost invariably below their average number.

In certain cases which would appear to militate against the above, as in that mentioned by Montagu, in which “the hedge-chanter had four eggs when the cuckoo dropped in a fifth,” it is highly probable that the cuckoo had been disturbed, perhaps by the rightful owners of the nest, before she had had time to finish her operations. The writer of this has seen a meadow pipit attack most resolutely, and drive away, a cuckoo from the vicinity of its abode; he may pretty safely say from off its nest, as the cuckoo rose from the ground. It would appear, indeed, from the last mentioned fact stated by Mr. Hoy, as well as from some other cases that could be adduced, that the cuckoo invariably lays her own egg *previously* to destroying the others. It would otherwise seem rather difficult to account for another fact, that of two cuckoos' eggs being sometimes found in the same nest; of which three or four instances are upon record. “In May, 1829,” says Mr. Hoy, “I found two cuckoo's eggs in the same nest, and depended on witnessing a desperate struggle between the parties, but my hopes were frustrated by some person destroying

it." A similar instance has been related to the writer of this article, but which also met with a like fate. It is most probable that, in these cases, the eggs were laid by two different cuckoos; and the occurrence of this fact seems to show, that the cuckoo, in a hurry perhaps to ease herself of the burden as soon as possible, and fearful also of being caught upon the nest by its rightful owner, hardly looks at or notices the eggs of her dupe before laying her own, and that, afterwards, being unable to distinguish between her own egg and that of another cuckoo, she destroys neither.

The writer of this is unable to say positively, whether the European cuckoo ever *devours* the eggs of other birds, but he thinks it most probable that it does so; that the cuckoo sucks birds' eggs is everywhere a very common opinion throughout the country, but the mere fact of her destroying them would be sufficient to give rise to this opinion. A female specimen, however, in the writer's possession, has its plumage soiled in several places with yolk of egg, and, though little can be deduced from this circumstance, he thinks it worth while to mention it. It is quite certain that many exotic species, nearly allied to our cuckoo, do feed very much upon birds' eggs. Wilson says of the *Coccyzus Carolinensis*, that "they are accused, and with some justice, of sucking the eggs of other birds, like the crow, the blue-jay, and other pillagers;" and this is further confirmed by Audubon, who says, of the same species, that "the yellow-billed cuckoo of America robs smaller birds of their eggs, which it sucks on all occasions," &c. It is, therefore, more than probable, to judge from analogy, that the European cuckoo does the same.

Having now pretty copiously disposed of all that concerns the cuckoo's egg, we have next to detail the singular and wonderful instinct of the young cuckoo. We have seen that, in the American cattle-bird (see COW-BUNTING), nature has provided for the exclusive maintenance of the young stranger, by decreeing that the alien egg should invariably be hatched before the others with which it had been placed; but the young cuckoo being always a much stronger bird than its fellow-nestlings (when it has any), is endowed with the extraordinary instinct of ejecting them from the nest. This interesting fact was first made known to the world by the excellent Dr. Jenner, "who," as Wilson observes, "has since risen to immortal celebrity in a much nobler pursuit, and to whose genius and humanity the whole human race are under everlasting obligations." To this gentleman are we indebted for the discovery of some of the most interesting phenomena of the cuckoo's history; and honourable mention of his name should be made by every writer who has occasion to treat upon this bird. Speaking of the cuckoo's egg in the nest of the meadow pipit, Mr. Selby observes, "As the same period of incubation is common to both birds, the eggs are hatched nearly together, which no sooner takes place, than the young cuckoo proceeds instinctively to eject its young companions and any remaining eggs from the nest. To effect this object it contrives to work itself under its burden (the back, at this early age, being provided with a peculiar depression between the shoulders), and shuffling backwards to the edge of the nest, by a jerk rids itself of the incumbrance; and the operation is repeated, till the whole being thrown over, it remains sole possessor. This particular tendency prevails for about twelve days, after which the hollow space

between the shoulders is filled up; and when prevented from accomplishing its purpose till the expiration of that time, as if conscious of inability, it suffers its companion to remain unmolested." This latter curious fact was first discovered by Colonel Montagu, who (as has often since been done from curiosity), when bringing up a young cuckoo by hand, placed frequently another young bird in the nest with it, for the purpose of seeing it ejected by the cuckoo, and noticing the manner in which this is done. "Sometimes indeed," says he, "it failed, after much struggling, by reason of the strength of the young swallow, which was nearly full feathered; but, after a small respite from the seeming fatigue, it renewed its efforts, and seemed continually restless till it succeeded. At the end of the fifth day" (it had been five or six days hatched when taken) "this disposition ceased, and it suffered the swallow to remain in the nest unmolested."

A nest, however, upon the ground may sometimes be so situate, as to render it impossible for the young cuckoo to turn out its fellow nestlings, of which the writer of this has been told an instance wherein four callow wagtails were found dead, apparently starved, beneath the usurper of their abode.

The young cuckoo's plumage is exceedingly unlike that of the adult bird; so much so, that some of the cabinet naturalists have even described it as a distinct species, under the names of *Cuculus rufus* and *Cuculus hepaticus*. The whole upper parts are generally of a deep clove brown, tinged here and there with grey, and barred with rufous brown, sometimes also margined with whitish. There are usually three spots of white upon the back of the head, but these are sometimes wanting in the young females. The oval spots on the inner webs of the quills are reddish brown. Throat and under parts yellowish white, with transverse black bars; paler upon the belly, a line of demarcation being visible, where in the adult bird the grey ceases upon the breast. Irides, at first greyish, afterwards liver brown, and beginning to change to yellow about the time they leave us in September. Legs and toes primrose yellow. The whole plumage indeed having a pretty transversely barred appearance, which renders them handsomer than the adult birds.

Unlike every other British bird, except the swift and chimney swallow, they leave the country in this their nestling plumage; but do not, as has been suggested, gradually change, without moulting, to the adult colour; they moult about the middle of winter, but as they carry such an immense proportion of feather, the change occupies a longer period than that of most other birds, the young cuckoos having generally some traces of the immature plumage upon the wings when they reappear in spring. As the old females have always some transverse rufous bars upon the sides of the neck and breast, it is probable that these must have given rise to the supposition that the young cuckoos do not moult during their absence, but undergo, like the ptarmigan, a gradual change of colour.

Varieties of this species sometimes occur, as in most other birds, that is to say, variations of colour. The writer has seen a young albino individual, and also a very singular adult one, which was shot in spring, whilst it was repeating its cry. This bird has all the upper parts and breast of a bright rufous colour, beautifully barred with black; not at all resembling, however, the plumage of the immature cuckoo, but more that of the female kestrel hawk; although un-

questionably a mere variety of the common species, this interesting specimen much resembles a newly discovered smaller cuckoo from the Himalaya.

Like the raven and other birds in which the egg is disproportionately small, the young cuckoo grows very rapidly in the nest, and its diminutive foster parents are obliged to labour hard and perseveringly to satisfy its increasing voracity; it requires even to be tended for a longer period than any other bird with which we are acquainted, remaining five or six weeks in the nest; and even long after it has flown, its assiduous nurses may be seen to follow it with food; and in confinement it will very rarely feed of itself till it is two or three months old; at all times indeed, even when able to pick up its own food, preferring to be fed by those to whom it is accustomed. In a wild state, the young cuckoo that has begun to fly, however it may seek to hide itself, may generally be traced by a concourse of numerous small birds chattering around it, among which the swallow kind are mostly very conspicuous, seemingly endeavouring, to the utmost of their power, to annoy it; amidst all which turmoil the pair that have brought it up continue constantly to bring it caterpillars and other insects. A writer observes of one, in the Magazine of Natural History, that "it was seen again on June 12th, on the top of a wall near to the nest; and, while it was sitting here, an amusing and instructive sight presented itself. A thrush, which probably had a nest close by, in an adjoining garden, evinced the most passionate and marked antipathy toward the young cuckoo, by approaching it with feathers ruffled, beak open, and uttering an earnest cry; some small birds too drew near, as if to exhibit their dislike, and abet the thrush. This is indeed quite an ordinary fact; small birds seem to consider the young cuckoo as an enemy, and they persecute it with the same unrelenting hostility, and chatter round it with the same unwearied pertinacity which they exhibit toward a weasel or an owl. This is the more singular, as these very birds may, in their turn, themselves become the nurses of a young cuckoo. The same animosity is shown by the different swallows towards the old bird, which they frequently attack and buffet as it flies along.

The cuckoo's food consists principally of insects, chiefly however the larger caterpillars, whether smooth or hairy; these it first kills, by shaking and knocking them violently against the bough on which it is perched, and then renders them perfectly pliant by passing them several times through the bill, before it swallows them. In confinement it seems very fond of the common house-fly, which it will readily take from the hand of a person it is accustomed to. It also feeds largely in spring upon the common may chaffer (*Melolontha vulgaris*), and has been seen to capture dragon flies on the wing. As the summer advances it will attack various kinds of fruit, as cherries and currants. Most probably also, as has already been mentioned, it devours birds' eggs; but caterpillars are its principal and main food, the exuviae of which it casts up in the manner of a hawk, in pellets, about the size of a sparrow's egg. It is in search of these that the cuckoo is so often seen about fruit trees, to which it doubtless renders an efficient service, as it not only preys upon those which have grown to some size, but also, in the spring, may be frequently seen deliberately picking out the newly hatched larvæ from their webs; an operation which

has strangely enough been construed by many gardeners and others into "sucking the blossoms," if any meaning can be attached to this phrase.

Whilst feeding upon a tree, the cuckoo leans very forward upon the bough on which it is sitting, as it examines the foliage for caterpillars, its tail being generally raised; and it frequently takes very considerable leaps from bough to bough, considering the shortness of its legs. The writer of this has never seen it climb in any sort of way, nor walk up a branch, using its feet alternately; but conceives that the only use of its having two toes on each foot placed backward, is to enable it more firmly to grasp its perch whilst leaning so very forward.

"The tree cuckoos," observes Sir W. Jardine, "though often found near woods, and in richly clothed countries, are fond of open and extensive heaths or commons, studded or fringed with brush and forest: here they may expect an abundant supply of the foster parent to their young. Their gliding and turning motion, when flying in a thicket, is similar to that of the American *Coccyzus*. Like them, also, they are seldom on the ground; but when obliged to be near it, alight on some hillock or twig, where they will continue for a considerable time, swinging round their body in a rather ludicrous manner, with lowered wings and expanded tail, and uttering a rather low monotonous sound, resembling the *kowe* of the American bird—

'Turning round and round with *cutty-coo*.'

"When suddenly surprised or disturbed from their roost at night, they utter a short tremulous whistle, three or four times repeated; and it is only on their first arrival, during the early part of incubation, when in search of a mate, that their well-known and welcome note is heard: by the first of July all is silent." It is not, however, very often that an opportunity occurs of studying this bird's habits so very minutely; all are acquainted with its note, and there are few persons residing in the country, but must have often observed it, as, somewhat in the manner of a pigeon, but less steadily, it wings its way from tree to tree; but the bird is so vigilant and shy, that very few even of those who try to study its habits, can ever get to notice it more particularly, excepting, perhaps, by mere accident, once or twice only in their lives.

When first taken from the nest, the young cuckoo is extremely savage and voracious, buffeting and sparring with its wings like a gamecock, and uttering all the time a shrill cry. They are easily enough reared upon raw meat, but are difficult to keep through the winter, being very tender about the moulting period, which usually takes place about January. In the course of a little time, they mostly become tolerably attached to those they know, but are generally very shy before strangers. Buffon, indeed, says, "though cunning and solitary, the cuckoo may be given some sort of education. Several persons of my acquaintance have reared and tamed them. They feed them on minced meat, either dressed or raw, insects, eggs, soaked bread, and fruit. One of these tamed cuckoos knew its master, came at his call, followed him to the chase, perched on his gun, and if it found a cherry tree in its way it would fly to it, and not return till it had eaten plentifully; sometimes it would not return to its master for a whole day, but followed him at a distance, flying from tree to tree." The writer of this article has seen a pair that were

tolerably tame, that were allowed the free range of a large kitchen, where they commonly used to sit upon the fender, warming themselves by the fire. They are apt in confinement to suffer very much from excess of the migratory feeling, which not unfrequently causes the death of those that are prevented from following this natural impulse.

Upon the whole this species exhibits, when in a state of confinement, a greater degree of attachment to its feeder than we should be prepared to expect. Its brain, we may remark, is very small, scarcely weighing twenty grains, which only exceeds the weight of one of its eyes by a grain and a half.

The old cuckoos are always the very first of our summer migrants to leave the country, as the majority of them retire southward in the first week in July. Woodmen and others say that they congregate, before taking their departure, in flocks of twenty or thirty; and the writer of this is likewise informed, upon very good authority, of a flock of sixteen young ones being seen, in September, in the north of Scotland, flying in a south-easterly direction towards the German ocean, which, at the place of observation, was distant about half a mile. It is probably only in the less populous districts that this can ever be observed. Where the mass of them spend the winter has never been specifically ascertained, though specimens have been received from Egypt.

"Naturalists," says Mr. Selby, "have been puzzled to account for this bird not performing the office of incubation, but as their researches have principally been directed to the anatomical structure, in which point it does not essentially differ from many others that perform this office, we arrive by these means at nothing satisfactory. The above peculiarity of this remarkable genus must not probably be looked for in any principle of conformation, but must be explained from their habits and economy.

"Let it be remembered these birds are migratory, and that the period during which the adults remain with us is very short; but the propagation of the species must be effected during that period. Now, as their arrival does not take place before the month of April, and the egg is seldom ready for incubation before the middle of May, there would not be a sufficient length of time for the young to be hatched, or (making every allowance) sufficiently fledged to accompany the old birds at the period of their departure, which seldom or never extends," in the north of England, "beyond the first week in July."

This perhaps is about as good an explanation of the cuckoo's peculiarities as has hitherto been offered, but it fails, like all the rest, in being quite inapplicable to the case of the North American cow-bunting. The true cause (whatever that may be) of this extraordinary deviation must, we are persuaded, be the same in both; nor can we at present consider any explanation as satisfactory that will not alike apply to either. That the old cuckoos, however, should retire southward in the very hottest part of the summer is certainly a very curious matter, and the cause of this requires further investigation. It cannot be for want of food, for they are then always in prime condition; and caterpillars, their main subsistence, are then much more abundant than when they arrive in spring. No observations, however, have as yet been made upon the cuckoo in its winter quarters, and till this has been done it is of little use attempting to theorise upon the subject. The natural history of

this remarkable bird still offers a wide field for investigation, and it will probably be a long time yet before our knowledge of it can be any thing like complete. It is, without exception, the most extraordinary bird that occurs on the European continent, and as such it merits peculiar and close attention from all who take an interest in natural history. Observations upon it must be multiplied, both at home and abroad, and a great deal must yet be elicited, before a variety of points can be cleared up on which at present we have little more than conjecture.

Of the genus *Cuculus*, a considerable number of species are enumerated, inhabiting different parts of the eastern continent, but chiefly Africa, and varying in size from double that of our bird to less than half. We know, however, very little of their habits, and nothing but what is in entire accordance with those of the species which inhabits Europe. Like it, they are all understood to deposit their eggs in the nests of other birds, but the fact, we believe, has not been ascertained in more than one or two, and even in these rests as yet on the authority of a single observer. Instead, therefore, of entering here into a long detail of colours and proportions, which are very little interesting to the general reader, we will pass on at once to give a brief account of their American representatives, the members of the genus *Coccyzus*, which, with one or two exceptions in Africa, are all confined to the western division of the globe; and we do this the rather, as our account of the European cuckoo has been extended to a very considerable length.

The *Coccyzi*, as a group, are mostly rather smaller than the true cuckoos, which in their general appearance they much resemble. The bill is, however, rather larger in proportion, and the tarsi longer, and bare of feathers. Their plumage is generally rufous on the upper parts, white beneath, and more or less marked, with white upon the tail; and, unlike the cuckoos, the young much resemble the adults. They are rather more confined to the interior of woods than the true cuckoos, and they build their own nests, and rear their young. Several beautiful species are found in South America, and two in the northern division of that continent, one of which has been already mentioned as an occasional straggler to the British islands. This bird, the *Coccyzus Carolinensis*, is thirteen inches long, and sixteen in extent of wing, the whole upper parts are of a dark glossy drab, or what is commonly called a quaker colour, with greenish silky reflections; inner vanes of the wings bright reddish cinnamon. Tail long, composed of twelve feathers, the two middle ones being the same colour as the back, the others, which gradually shorten to the exterior ones, are black, largely tipped with white; the two outer ones scarcely half the length of the middle ones. All the under parts pure white, the feathers covering the thighs (*tibiæ*) being long, as in the hawk tribe. Legs and feet light blue. Bill dusky black above, and yellow below. Irides hazel, with the eyelids bright yellow. The female much resembles the other sex, but has four of the middle tail feathers like the back, and her white is not quite so pure.

"A stranger," says Wilson, "who visits the United States for the purpose of examining their natural productions, and passes through our woods in the month of May or June, will sometimes hear, as he traverses the borders of deep, retired, high timbered hollows, an unceasing guttural sound or note, resembling the syllables *kowe, kowe, kowe-kowe-kowe*, beginning

slowly, but ending so rapidly that the notes seem to run into each other, and vice versa; he will hear this frequently without being able to discover the bird or animal from which it proceeds, as it is both shy and solitary, seeking always the thickest foliage for concealment; a trait in its character, by the way, closely reminding us of the European cuckoo. "This," continues Wilson, "is the yellow billed cuckoo (*Coccyzus*), the subject of the present account. From the imitative sound of its note, it is known in many parts by the name of the *Cow-bird*; it is also called in Virginia the *Rain-crow*, being observed to be most clamorous immediately before rain.

"This species arrives in Pennsylvania from the south about the 22nd of April, and spreads over the country, as far at least as Lake Ontario; it is numerous in the Chickasaw and Choctaw nations, and also breeds in the upper parts of Georgia; preferring in all these places the borders of solitary swamps and apple orchards. It leaves us, on its return southward, about the middle of September." Mr. Audubon adds, that "in their migrations northward they move singly, but when removing again to a warmer latitude they appear to be gregarious, flying high in the air, and in loose flocks." This tends analogically to confirm what we have already advanced concerning the European cuckoo's migration. That species seems also to arrive singly, and to depart southward in small flocks.

"Early in May," says Wilson, "they begin to pair, when obstinate battles take place among the males. About the 10th of that month they commence building. The nest is usually fixed among the horizontal branches of an apple tree; sometimes in a solitary thorn, crab, or cedar, in some retired part of the woods. It is constructed with little art, and scarcely any concavity, of small sticks and twigs, intermixed with green weeds, and blossoms of the common maple. On this almost flat bed the eggs, usually three or four in number, are placed; these are of a uniform greenish blue colour, and of a size proportionable to that of the bird. While the female is sitting the male is generally not far distant, and gives the alarm, by his notes, when any person is approaching. The female sits so close that you may almost reach her with your hand, and then precipitates herself to the ground, feigning lameness, to draw you away from the spot, fluttering, trailing her wings, and tumbling over, in the manner of the partridge, woodcock, and many other species." We cannot but contrast this affectionate display of parental feeling with the conduct of the European cuckoo. Some writers, however, as Dr. Darwin and others, even state of that species, that it sometimes builds a nest and rears its own progeny; but the instances they mention clearly show that they had mistaken a very different bird, the nightjar, for a cuckoo; the accounts which they furnish accord entirely with the nidification of that species, which indeed in the nest bears no inconsiderable resemblance to it; and the writer of this has himself known an instance of a young nightjar being mistaken for a cuckoo. Still it would be interesting, before we entirely divest the European cuckoo of all parental affection, to try whether an old caged one would take any notice of a nestling of its own species that was placed along with it; to see whether it would be moved, like other birds, by its helpless cries, and ever place food into its mouth. We should imagine, however, that it would not.

"Both parents," continues Wilson, "of the Carolina *Coccyzus* unite in providing food for the young. This consists, for the most part, of caterpillars, particularly such as infest apple trees. The same insects constitute the chief part of their own sustenance. They are accused, and with some justice, of sucking the eggs of other birds, like the crow, the blue jay, and other pillagers. They also occasionally eat various kinds of berries. But, from the circumstance of destroying such numbers of very noxious larvæ, they prove themselves the friends of the farmer, and are highly deserving of his protection.

"In examining this bird by dissection, the inner membrane of the gizzard, which in many other species is so hard and muscular, in this is extremely lax and soft, capable of great distension; and, what is remarkable, is covered with a growth of fine down or hair, of a light fawn colour. It is difficult to ascertain the particular purpose which nature intends by this excrescence; perhaps it may serve to shield the tender parts from the irritating effects produced by the hairs of certain caterpillars, some of which are said to be almost equal to the sting of a nettle." The same has also been said, first probably by some compiler who had read Wilson's article and who thought he might safely enough infer it from analogy, of the stomach of the European cuckoo, but the writer of this has dissected several, and never observed any thing of the kind. The cuckoo's stomach is, however, lax and membranous, like that of the American bird.

Black billed *Coccyzus* (*C. erythrophthalmus*). "This species," according to Wilson, "is nearly as numerous as the former, * * * its peculiar markings, however, and some of its habits, sufficiently characterise it as a distinct species. Its general colour above is nearly that of the former, inclining more to a pale ash on the cheeks and front; it is about an inch less in length; the tail is of a uniform dark silky drab, except at the tip, where each feather is marked with a spot of white, bordered with a slight touch of dull black; the bill is wholly black, and much smaller than that of the preceding, and it wants the bright cinnamon on the wings. But what constitutes its most distinguishing trait is a bare wrinkled skin of a deep red colour, that surrounds the eye," whence the species have, though not very accurately, been named *erythrophthalmus*, or red-eyed.

"The black-billed *Coccyzus* is particularly fond of the sides of creeks, feeding on small shell-fish, snails, &c. I have also found broken pieces of oyster-shell in its gizzard, which, like that of the other, is covered with fine downy hair." Audubon found in the stomach of this bird, in addition to shells and water insects, "a small black frog, which appears after a summer shower." The sustenance, therefore, of this species is rather anomalous, and peculiar for a member of the cuckoo family.

"Its nest is commonly built in a cedar, much in the same manner and of nearly the same materials as that of the other; but the eggs are smaller, usually four or five in number, and of a rather deeper greenish blue."

There is nothing known of the peculiar habits of the other species of this division, so it would be here little interesting to detail their colours and proportions. A notice of other birds allied to the cuckoo will be found in the articles *LEPTOSOMUS*, *INDICATOR*, and *PHENICOPTERUS*.

CUCKOO FLOWER is the *Lychnis flos-cuculi* of Linnæus, a common British plant found in moist meadows. It belongs to the tenth class and fifth order of the sexual system, and to the natural order *Caryophyllææ*. The *Cardamine pratensis*, another common plant in moist meadows, is also called cuckoo flower, but the plants are in no way connected except in habitat.

CUCUJIDÆ (Stephens; PLATYSOMA, Latreille). A family of coleopterous insects of small extent and lignivorous habits, placed between the *Xylophaga* and the *Longicornes*, having the tarsal joints entire and not bilobed; the antennæ are of an equal thickness, or slender at the tips; in some species, however, the three terminal joints are incrassated; the jaws are robust and exerted, and the body very much depressed and of an oblong form. These insects are of small size, and are found beneath the bark of trees, where also the larvæ reside. Their situation appears to be much nearer to some of the *Necrophagous Pentamera*, such as *Ips*, than to the *Longicorn Tetramera*. The genera are *Cucujus*, *Dendrophagus* and *Uleoiota*, to which Mr. Stephens has added that of *Trogosita* of Fabricius. The typical genus has the antennæ shorter than the body, with the basal joint shorter than the head. There are several British species, but their synonymy is very confused. The males of *Uleoiota flavipes* have the mandibles armed with a remarkable curved horn.

CUCULINÆ (Latreille). A subdivision of the insects composing the family *Apidæ*, or true long-tongued bees, distinguished by the non-possession of organs for the gathering of pollen, and consequently compelled to resort to the nests of other bees for the deposition of their eggs. Hence, like the cuckoo, they may be regarded as a kind of parasite. The larvæ of all bees are nourished by a paste formed of pollen and honey, but in nearly one-third of the genera of these insects the females are destitute both of pollen brushes and pollen plates. Having, therefore, with much artifice succeeded in introducing its eggs in the already provisioned nests of other working bees, the female cuckoo bee is enabled, without the toil of constructing a nest, to ensure for its progeny as much benefit as though it had been especially provided for, since the parasite larva is supposed to hatch before the larva which is the true inhabitant of the cell, and of course it immediately devours the supply of pollen paste, so that when the real inhabitant is hatched, its food being consumed, it is of course starved to death. But this parasitic kind of connection exists in other groups besides those included by Latreille in the family *Cuculinæ*: thus some of the humble bees* (*Bombus*) are in like manner destitute of polliniferous organs, and compose the genus *Psithyrus* of St. Fargeau (*Apathus*, Newman; *Pseudobombus*, Stephens); whilst other genera, not only amongst the *Apidæ*, but also in the *Andrenidæ* (short tongued bees), and even in the *Fossorial hymenoptera*, are similarly circumstanced. As, however, the structure of these parasite bees (except as regards their polliniferous organs) is in many cases too nearly identical† with that of the bees, in the nests of which they are parasitic (compare *Bombus* and *Psithyrus*, which Mr. Curtis thinks should not be even gene-

rically separated), we do not feel inclined to adopt the step taken by Mr. Newman of uniting them all, whether *Apidæ* or *Andrenidæ*, together under the name of *Apathites*, although, for convenience' sake, we have followed the steps of Latreille in keeping the *Cuculinæ* as a distinct group. See *APIDÆ*. The genera introduced by Latreille into this subdivision are, *Ammobates*, *Philcremus*, *Epcolus*, *Nomada*, *Psitics*, *Melecta*, *Crocisa*, and *Oxæa*.

CUCULLÆA (Lamarck; ARCA CUCULLUS, Linnæus). This genus nearly resembles the Linnæan *Arks*, from which modern naturalists have generally separated it. De Blainville, however, in this instance as in many others, with a view to conform as closely as possible to the system established by that illustrious naturalist, and not to multiply genera uselessly, has made it a subdivision of the genus *Arca*; in this we do not coincide altogether, as there are some manifest distinctions of structure which indicate a different inhabitant. The shape is more gibbous, or trapeziform; the anterior side truncated obliquely, and at the hinge (which in young shells is similar to that of the *Ark*), by growth or age, becomes displaced, or appears obsolete, exhibiting parallel ribs, which terminate it and give the teeth a more horizontal appearance than in the *Arks*, as they are now defined by Lamarck. But the most remarkable distinction, and one from whence its name of *hooded* has been derived, are the ear-shaped testaceous appendages, placed internally at an angle with the anterior surface, on one side of the muscular impression of the valves; these form a species of chamber or division, and are not to be found so situated in any other species of mollusc. The shell is equivalve, inequilateral, rhomboidal, heart-shaped, truncated at one end, and very globose; the umbones distant and separated by the angular groove or area of the ligament, which is altogether external; the hinge linear, straight, with small transverse teeth, having at its extremity from two to five parallel ribs. Lamarck does not mention that the valves are marked with minute and strong longitudinal striæ, *one valve often overlapping the opposite one*, and that the margins of them are crenulated. From this difference in the size of the valves, many collectors have supposed examples with the ligament broken, not true pairs; but it is a character peculiar to this genus, and also to some of the *Arks*, though not constantly observable in either. It is a circumstance rarely occurring in other bivalves, and one only to be accounted for hypothetically, by supposing the animal to complete the enlargement of his dwelling on one side first, and not on both simultaneously; and this is rendered the more probable, as it is found not to be a constant characteristic. It closely allies this genus with them, and is a proof of the truth exhibited, and the necessity of combining a knowledge of the animal with the distinctions furnished by its dwelling, in order to constitute a correct system of classification. This is the science of malacology.

CUCULLIA (Schrank). A genus of lepidopterous insects belonging to the section *Nocturna*, and family *Noctuidæ*, having the upper wings long and lancet shaped, acute at the tips, the abdomen elongated, and the spiral tongue as long as the antennæ. These moths are called sharks by the English collectors. The generic name is given to them in allusion to the hooded thorax. The species are very difficult to discriminate, from their great resemblance in the pre-

* For an account of the genus *Bombus*, or the humble bees, see HUMBLE BEE.

† The quotation from Mr. Selby, given in p. 195, relating to the cuckoo, may, to a certain extent, be applied with equal force to these cuckoo bees.

fect state, the caterpillars affording the best characters for specific differences in the genus. The moths fly very strongly. Reaumur has given us an account of the proceedings of the larvæ of one of these moths (*C. scrophulariæ*), in the construction of its cocoon, which is formed of particles of earth fastened together. Having dug up one of these caterpillars which had just completed its case, he broke off one end, in order to see the manner in which the insect would repair the damage. After thrusting out its body almost to its full extent, and reconnoitering the adjacent ground, it selected a grain of earth and fastened it into the breach with a thread of silk; proceeding in this way, it almost closed the hole, the outside being built of larger grains, and the interior of finer. Moreover, previous to completely closing the aperture, it gathered a quantity of earth on the inside, which it thrust with its head into a silken network woven over the part which still remained open, by which means the whole was rendered opaque and equally firm with the unbroken part. There are about a dozen British species, including the typical species above mentioned, which is one inch and three quarters in expanse. The larva is found upon the water betony. The larvæ of all the species are handsome caterpillars, and the chrysalides have the head-case produced.

CUCUMBER, is the *Cucumis sativa* of Linnæus, and a well-known horticultural plant, extensively cultivated for its green fruit.

Of the cucumber, it may be averred, that there is no plant in cultivation which receives more care and attention from the kitchen-gardener than this. The earlier the fruit can be had in the season, the more they are prized. Fruit in general are most valuable when mature; the cucumber, on the contrary, is only useful when very young and green; indeed, the younger the fruit, when large enough for table, the more it is esteemed.

A fine cucumber brought to table on Christmas day, and which has been cut from a plant raised from seed sowed after the 20th of October preceding, is certainly the most costly fruit ever seen on the tables of the rich. For estimating the time, labour, and materials employed in the production of such a luxury, the expense is certainly greater than is bestowed on any other vegetable delicacy. It is true, a gardener is not kept entirely for the purpose of growing early cucumbers, this being only a part of his other more material duties; but, calculating the attention and time dedicated to this sole object, the labour greatly exceeds the worth of the production. However, as it is one of those gratifications expected from the possession of an expensively kept kitchen garden, it should always make a part of the superintendent's duty.

As an exotic, and the production of a warm climate, it requires an artificial temperature in this country, more especially when cultivated during our coldest season. This can only be afforded by fire-heat, or that of some fermentable substance. The most common, because the most plentiful material for the purpose, is stable litter, after being thrown to the dunghill, which being properly prepared by frequent turning, to allow the rank ammonious steam to evaporate, is made into beds, covered with frames and glazed sashes, and with suitable compost to receive the plants.

There are various ways of forming the beds; some are formed entirely of prepared dung, raised four feet or more in height, on which the frame and

lights are set. However high this hotbed may be raised, its heat will decline at last, and often, at the very time a lively bottom heat is most wanted; in this case, linings of hot dung are applied to renew the heat, and which require to be often repeated. The greatest objections to this kind of hotbed are—the heat is too strong at first, and when it declines, sufficient heat cannot be imparted to the middle of the bed by linings. From the first the plants are liable to be burnt; and from the second, chilled. To avoid these extremes, some gardeners make a new dungbed, of moderate depth, on the top of an old one, and trust entirely to linings for bringing the plants to perfection. By this plan, there is no fear of burning the roots; and when the linings are timely applied, this method succeeds very well. Others dig pits for hotbeds, having the sides and ends of open, or pigeon-hole brick-work, leaving a vacuity two feet wide all round, for the reception of linings, on which the cultivator chiefly depends for a sufficient and equable degree of heat. In this mode, it is usual to fill the pit within the walls with brickbats, or brushwood, half way up, on which the prepared dung and compost are laid, to receive the plants. By these means the heat from the linings is collected in the hollow brushwood-filled space, whence it rises in a constant and moderated stream through the dung and mould of the bed, gently exciting and nourishing the plants. Others, again, to be free from the labour of applying linings every ten or twelve days, have a steam, or hot-air chamber, under the bed, whence the requisite heat is derived. In short, there are scores of different schemes for growing early cucumbers, and all are more or less successful, according to the degree of attention or skill bestowed on the culture.

At one time, growing early cucumbers for prizes given at shows, was a favourite amusement among many gardeners round London and some other places. The competitors were bound, by certain rules, as to the time of sowing, viz.—not till after the 20th of October, and the prizes were awarded to the finest and most perfect fruit. Length, regular shape, greenness, regularly garnished with short black prickles, finely covered with a white mealiness, called bloom, and, if still bearing the unfaded blossom on the end, all, or the greatest number of these properties, combined in any one fruit, determined the judges in making their award, and without knowing to whom the fruit belonged till after they had given judgment. It is hardly to be credited with what exactness these punctilios were attended to by the judges, and what pains were taken by the competitors to grow and show fruit answering to the established ideas of a perfect show-cucumber. Glass tubes, and various other modes of confinement, were practiced to give the proper shape. If any prickles were wanting, others, taken from inferior fruit, were ingeniously substituted. If the mealy bloom had disappeared, it was restored by an easy process of puffing hair-powder, or some such floury matter, upon it, in a box made for the purpose; and as it often happened that fine fruit would be ready long before the show-day, the growers had a clever device of keeping them in a fresh unaltered state, by burying them (properly packed) deep in the ground. In fact, the business of growing and showing cucumbers for prizes was a distinct branch of the gardener's occupation, and excelled in but by few.

The ordinary process of raising early cucumbers is executed as follows:—About the beginning of October, a sufficient quantity of fresh stable dung is got together in a convenient open place, where it can be repeatedly turned, watered if too dry, and intimately incorporated, so that no part of the heap shall be wetter or drier than another, but all of equal colour and temperament. On the careful preparation of dung intended for hotbeds, as already observed, much of the success of their purpose depends. If the dung be too wet, the heat rises too violently at first, and is too soon over; and if it has not been turned enough, and all the rank qualities dissipated, the effluvia rising from the bed, after being made, would be highly injurious to the young plants.

Of such prepared dung, a seed-bed for a one light box or frame is made about the 15th of October. By the 20th, the heat will have risen, and its quality judged of, whether an agreeable sweet heat, or having a strong ammoniacal scent; if the latter, it must have time to pass off, or be qualified by a covering of dry leaf-mould or saw-dust. Previous to sowing the seed, pots, or deep pans, filled with a compost of equal parts of fresh loam, leaf-mould, and well rotted dry dung, should be set within the frame to get warm. In this single seeds are dropped two inches apart, and covered half an inch deep. The air within the frame should be kept at about 65° or 70° of Fahrenheit.

It is usual to prefer seeds three or four years old for early forcing, because plants from these show fruit sooner. But some practitioners prefer new, or such as has been saved in the same year, because, say they, the seedlings are more vigorous; and though the plants may require more stopping, they yield at last finer fruit, and nearly as soon as plants raised from old seeds.

In sowing, it is well to place each seed on a nodule of decayed dung, as on this the first fibres take firm hold, and which renders their removal into pots easy and safe, and which transplanting should be done as soon as the seedlings show their first bud of rough leaves. The plants are placed two or three together in each pot, watered, and immediately plunged in the seed-bed. They should be kept within six inches of the glass, receive fresh air daily, and be securely covered on nights by mats fastened to the frame.

While the seedlings are thus being reared in the seed-bed, a fruiting-bed must be prepared for them. The different methods of making these we have already described; and here it only remains to add, that when the fruiting-bed is ready to receive the plants, by having hills of compost laid under each light or sash of the frame, when a due degree of heat has risen through them, and the air within, sweet and of proper temperature, a pot of plants is turned out, and placed on the top of each hill, about six inches from the glass. In doing this, the ball of roots discharged from the pot is kept entire, and the compost pressed closely round, and about an inch in thickness over the top, among the stems. This will induce the production of new roots from the stems, and greatly assist the establishment of the plants in their new abode. If heat from below, moisture in the mould, and air within the frame, be regulated properly, and if water (warm) and fresh air be given cautiously, and every ray of light admitted, with sufficient coverings on nights, the roots will soon extend themselves

through the sides of the hills, in which case additions of compost are from time to time applied, till the whole surface of the bed is covered, and which should be at the general depth of about ten inches.

At this time the season is, perhaps, becoming more and more severe, and therefore the heat must not be allowed to fail, but rather, if possible, increased, and so continued, to swell off the fruit. The temperature of the bed may be lowered or heightened by the thickness of the night coverings, and these must be regulated according to the degree of bottom heat obtained from the means employed, whatever these may be.

A very material part of the management of the cucumber plant depends on the pruning it receives. It is a climbing vegetable; its tendency to grow upwards, and support itself by its tendrils on other plants, must be counteracted in the earliest stage of its growth, by pinching off the extremity of the leading, or principal shoot. This appears like a bud at the base of the first rough leaf on the first joint above, and between the cotyledons or seed-leaves, and soon as it is of the size of a small pea, must be removed. This mutilation induces the production of lateral branches, which readily take a horizontal range, and are allowed to run till they show fruit. But if they produce nothing but male flowers, on the first fourteen inches of their growth, they should be again stopped, to cause the production of a second set of branches, which rarely fail to show fruit abundantly.

As soon as the female flowers are fairly expanded, it is an old custom to impregnate them by hand. In such a situation, where neither bees nor wind can enter, manual assistance appears to be necessary; for, though it is no object whether or not the seeds of such fruit be impregnated, and though it is known that unimpregnated fruit arrive at a certain degree of perfection, it is also well known that a duly fecundified fruit swells faster than one which has had no impact of the pollen at all. This being the case, it is well to follow the old custom, as it certainly can do no harm.

The compost for cucumbers should be rich and porous; rich, because the plant is a "gross feeder;" and perfectly loose, to prevent burning, by giving a free transit to the humid warmth from below. The openness of the compost also admits water readily, and gives free scope to the spreading roots. Leaf-mould, and fresh and turfy loam, which has lain under a heap of good dung for a month or two, and afterwards mixed with twice its bulk of leaf-mould, will be found very suitable.

It has been already observed, that the rank steam of stable-dung is destructive to young cucumber plants, as indeed it is to most others; but after this rankness is gone off, they appear not to be averse to the mild effluvia arising from the body of the bed. On this account it is a good practice, in order that this effluvia may be evolved more copiously, to water and hand-fork up the dung between the hills frequently before the bed is moulded over; and yet, after linings begin to be applied, care must be taken that the warm steam from them does not enter the frame, which it is apt to do, especially if the night-coverings are suffered to project, or hang over the new linings. A further precaution is, to cover the linings with boards or dry earth.

If the attempt to obtain early cucumbers has been

successful, perfect fruit may be had about Christmas, or soon after; but, as it is only adepts in the art of forcing who can insure such a result, few gardeners begin hotbed-forcing before the 1st of January, especially where there are pinneries in which cucumbers may be had throughout the winter. But, whenever hotbed-forcing is commenced, the same processes as detailed above are had recourse to, even up to the time they are planted in the open air, except only that the beds are not made so substantial, nor are linings so often required as in winter.

Cucumbers are successfully cultivated in the open air by the assistance of small pitfuls of hot dung and hand-glasses. About the beginning of April, seeds are sown in a hotbed in quantity according to the number of hand-glasses intended to be used. The seedlings, when fit, are potted into forty-eight or thirty-two sized pots, three plants in each. These are kept in the hotbed, stopped, watered, &c., till about the 20th of May, when the pits or ridges should be ready to receive them. A row of pits, each two feet square and fourteen inches deep, are made, the earth being laid round in the form of a ridge lengthways. The pits are two feet apart from each other, and are filled with hot dung prepared for the purpose, firmly beaten in, and raised somewhat higher than the natural surface of the ground. In the centre of the dung, in each pit, direction-sticks are placed, which serve to point out the depth of compost to be laid on, as well as the exact place of the hand-glasses. Round these sticks the compost is laid in a square form, to receive the glasses, which, for the sake of regularity, are set by line. Next day the heat will have warmed the compost; a pot of plants is turned out, and placed in the centre where the direction-sticks stood; water is given, and the glasses put on, and shaded with a mat for a day or two, till the plants have recovered the check of removal. On the third, and every following day, the glasses should be tilted on the south side by a brickbat, and shut close down again on nights, and always also in inclement weather. Three feet of the ground, on each side of the glasses, should be dunged and digged, working the earth towards the glasses in a ridge-like form, on which the branches of the plants are laid when they are laid out from under the glasses. This takes place when the leaves and vines have filled the glasses; the latter are then lifted off, and the former are laid out around, and carefully secured to the ground by small hooks. The glasses are again replaced, but supported by bats all round. This replacing of the glasses is not for the purpose of attracting or keeping in heat, but for defending the dung and stems from immoderate and chilling rain.

This method of growing cucumbers is well imitated by the cottager, who uses green weeds instead of dung, and an old garment instead of a hand-glass.

Cucumbers for pickling may be grown without hot-dung pits, if the plants be raised in a hotbed, and planted out on warm borders about the end of May; or, on the same situation, if the seeds of the short prickly sort be sown on well digged rich ground, a fair yield of picklers may be obtained before the frosts of autumn kill the plants.

There are many varieties of this plant. The favourite kinds for early forcing are the Early Frame, Long Frame, and the Fine Southgate. For ridging out under hand-glasses, there are

The Ridge Cucumber, Early Cluster,

Long Prickly,
Short Prickly,
White Spined,

Green Prickly,
White Turkey, and the
Green Turkey.

CUCUMIS (Linnæus). A rather extensive and useful genus of creeping or climbing annual plants, natives of many different parts of the warmer regions of the world. Linnæan class and order *Monœcia* *Monadelphica*, and natural order *Cucurbitaceæ*. For descriptions of this genus and its alliances, see CUCURBITACEÆ.

CUCURBITACEÆ — the gourd family. A natural order of dicotyledonous plants, containing twenty-one known genera, and nearly two hundred species. It is closely allied to *Passifloræ*, differing however from this order in its monopetalous corolla, sinuous stamens, unisexual flowers and exalbuminous seeds. It also bears some affinity to *Myrtaceæ* and *Onagraceæ*. The essential characters of the order are: flowers usually unisexual; sepals five, more or less united, sometimes obsolete; petals five, often more or less united, and sometimes continuous with the calyx, with strongly marked reticulated veins, sometimes fringed; stamens five, distinct or cohering in three bundles; anthers two-celled, very long and sinuous; ovary inferior, one-celled, combined with the calyx; style short; stigmas three to five, two-lobed, thick, velvety, or fringed; fruit fleshy, more or less succulent, crowned by the scar of the calyx, one-celled, with three parietal placentas; seeds flat, ovate, enveloped in an arillus, which is either juicy or dry and membranous; testa coriaceous, often thick at the margin; embryo straight, without albumen; cotyledons foliaceous, veined; radicle next the hilum.

The plants belonging to this order are herbs, having annual or perennial, fibrous or tuberous roots, succulent stems climbing by means of lateral tendrils, palmated alternate, rough leaves, and solitary or paniced flowers of a white, red, or yellow colour. They are found in hot climates in both hemispheres, but chiefly within the tropics. They are most abundant in India; a few exist in the northern parts of Europe and America; and some grow at the Cape of Good Hope.

This order is one of the most useful in the vegetable kingdom, containing the various species of gourd, cucumber, and melon, which are well known as articles of food; and furnishing colocynth and elaterium, which are valuable in a medical point of view. In general the properties of the order may be said to be bitter and laxative. These qualities pervade more or less all the species of the order, and according to the degree in which they are exhibited, the plants become esculent or purgative. Some of the gourd tribe contain a resinous principle in which the activity of the plant resides, while in others its place is supplied by milder ingredients, such as mucilage and water. The seeds of cucurbitaceæ are sweet and oily, and are capable of forming an emulsion with water. Their leaves and roots are frequently filled with an acrid, bitter, and drastic juice.

The order has been divided by Decandolle into two sections, *Nhandirobeæ* and the true *Cucurbitaceæ*. The former includes the genera *Fevillea* or *Nhandiroba* and *Zanonia*, while the latter comprehends the genera *Cucurbita*, *Cucumis*, *Bryonia*, *Elaterium*, *Momordica*, *Joliffia*, &c.

We shall first notice the genus *Cucumis*, as furnishing a good illustration of the properties of the order.

Cucumis sativus is familiar to every one as yielding

the common cucumber. Its original station has not been accurately ascertained. It is the *Ketimon* or *Timon* of the Indians, and is considered by many as a native of Tartary and the East Indies. It was introduced into this country in 1597, and is at present in general cultivation everywhere. There are several varieties of the plant, the most important of which are, the green cucumber, the yellow, the white, the variegated, and the peaked.

The common rough green prickly cucumber produces fruit six or seven inches long, of a dark green colour, and set with small prickles. It bears well, but not early. The short green prickly bears a smoother fruit, three or four inches long. It is one of the hardiest and earliest of the varieties. The long green prickly, the early green cluster, the long smooth green and white Turkey, the large smooth green Roman, and the long white prickly Dutch, are well known to gardeners all over the country.

Cucumber seeds are sown in hotbeds covered with frames and glasses for early fruit, and in the open ground for late crops. The earthy mould, which is spread over the dung of the hotbed, ought to be light and of a rich quality. The glasses should be covered with mats or straw during the night, so as to protect the plants from the cold. A regular supply of heat and a due allowance of moisture are the circumstances which demand attention in their cultivation. There are generally three crops in the year: the first in March and April, from the plants reared altogether in the hotbed; the second in May and June, from those which are raised under hand-glasses; and the third in August and September, from those which have grown on ridges in the open air without artificial heat. The early short and long prickly sorts are preferred for the first crops. In cultivation, those with the smoothest rind and fewest seeds are most esteemed. The cucumber has not the sweet taste and delightful perfume of the melon. When fresh, it is insipid, watery, and even in some degree nauseous. After its outer covering has been taken off, it is cut into thin slices and eaten with vinegar, oil, and pepper. It is not very nutritive, but is greatly relished by many persons. The emperor Tiberius is said to have been very fond of cucumbers, and by proper management he was able to procure one every day at all seasons of the year.

The pulp of the cucumber when fresh is employed as a cooling external application, and a pomade is made from it which is used to soften the skin and remove any slight scaly eruptions which may appear on it. The seeds are made into an emulsion. When in a young state, the cucumber is used for pickles under the name of *Girkins*.

Cucumbers are produced in great quantity in some parts of England. It is stated, that the village of Sandy in Bedfordshire has produced 10,000 bushels of cucumbers fit for pickling in the course of one week.

Cucumis Melo, common or musk melon, is a plant highly prized on account of the delicious fruit which it produces. It was originally a native of the western countries of Asia, and is called *Retimon* by the Indians. It has been cultivated in our gardens since the year 1570, and is extensively diffused all over Europe. There are several varieties of the plant, the chief of which are, the netted, the Cantaloupe (so called from a place near Rome where it is much cultivated), and the Maltese melon. By cultivation

the varieties of melon have of late been greatly multiplied.

The melon is raised from seeds, and requires the same apparatus and care as is necessary for the cucumber. The frames and pits should be rather deeper, and brick pits are in general preferred. For the early crops the seeds ought to be sown about the middle of January or the beginning of February, and sowings ought to take place again in March, so that a succession of crops may be obtained. After five or six weeks' growth in the first hotbeds, the plants may be transferred to fruiting beds where there is more space and a better supply of air. As the melons approach to maturity, pieces of slate or tile should be placed under each of them in order to prevent them being injured by damp, or acquiring an earthy flavour. Moisture ought not to be supplied in great quantity until the fruit is perfectly set.

The melon, on account of its luscious sweet taste, is valued as a summer fruit, and is commonly produced on our tables as an article of dessert. Its flesh is also preserved in vinegar and sugar. It is much more refreshing than nutritive. In France it is eaten in great quantity both before and during dinner. In that country it is a common addition to boiled beef. It is a fruit by no means well adapted for weak stomachs, inasmuch as it is digested with difficulty. It is apt to produce affections of the bowels and stomach, and as a good precaution ought always to be eaten with pepper or some aromatic stimulant. It is said to be beneficial in some chronic affections of the kidneys, bladder, and chest. The pulp of the fresh melon is sometimes applied with advantage to burns and contusions, and when boiled it forms a good emollient poultice. The seeds contain mucilage and fixed oil, and are known in France by the name of *Semences froides*. They are deprived of their outer covering and triturated with water, so as to form an emulsion, which has been administered in ischuria, inflammations of the kidneys and bladder, and in inflammatory fever.

Cucumis colocynthis, colocynth or bitter cucumber, is an annual plant which grows abundantly in Turkey, Nubia, and the Islands of the Archipelago, and is sometimes cultivated in other parts of Europe. The fruit of the plant is a yellow globular berry, the size of a small orange, containing a white spongy substance in which numerous seeds are imbedded. The fruit is much used in medicine, and is imported into this country from the Levant. It is gathered in autumn, when it begins to turn yellow, and having been deprived of its outer coat is dried quickly in a stove or in the sun. By this means the pulp is converted into a white papery looking matter, and in this state is commonly known by the name of *Coloquintida apple*. The white spongy or medullary part of the fruit, deprived of its rind and seeds, is the only portion of the plant which is employed medicinally. It is inodorous, and has an intensely bitter and nauseous taste. Alcohol extracts its bitterness, and acquires at the same time a yellow colour. The alcoholic solution, when evaporated, yields a resinous substance which, from being considered the active principle of the drug, has been denominated *Colocynthine*. It does not, however, appear that the proper purgative principle of colocynth has been discovered.

Colocynth is a drastic purgative, and as such was employed in ancient times by the Greeks and Romans for the cure of dropsies, apoplexy, madness, and

lethargic complaints. On account of its powerful effects, it requires to be administered with great caution. It acts chiefly on the lower part of the intestinal canal, and in large doses is apt to produce violent griping, and even inflammation. It has in some instances proved fatal, by causing severe vomiting and purging.

Colocynth is sometimes prescribed in substance in doses of five or six grains mixed with mucilaginous or farinaceous matter; but it is more commonly administered in the form of extract made into pills. It is sometimes combined with camphor and hyoscyamus, which tend to moderate its griping effects. The watery decoction or infusion is said to be milder than either the powder or extract, but its extreme bitterness prevents its general use. The compound colocynth pills, which are often sold under the name of Dr. Gregory's pills, are composed of the pulp of colocynth, aloes, scammony, oil of cloves, and sulphate of potass.

According to Thunberg, the fruit of the colocynth is rendered so perfectly mild at the Cape of Good Hope, by being properly pickled, that it is eaten both by natives and colonists. The seeds of the plant are bland and nutritious, and constitute an important article of food in northern Africa.

Cucumis citrullus formerly *Cucurbita citrullus*, the citrul, is a native of the south of Europe, and grows also in Africa and India. It is called *Lamanka* by the Indians. Two varieties of this plant are mentioned, the *Pasteque* and the *Water melon*. In the former the flesh or pulp is firm, while in the latter it is watery and of a reddish colour.

The water melon is a smooth globular fruit with a green exterior. It is cooling and refreshing, and is frequently produced at table in summer. It is much cultivated in the warm countries of Europe. In Provence the fruit is highly prized, and in India it is in great request during the hot season. In Egypt it is used to quench thirst, and to allay febrile excitement. The seeds are sown at the end of February in hotbeds, and the plants are afterwards removed to fruiting beds, and treated like cucumbers and common melons.

Cucumis anguria, round prickly cucumber, is a native of the West Indies, and forms an ingredient in soups. Besides this there are several other species of cucumis, which are cultivated in a similar manner for domestic use. They are not so important as those already noticed, and it is unnecessary to dwell upon them.

We shall therefore proceed to another genus, *Cucurbita* or gourd, whence the name of the order is derived.

Cucurbita Pepo or *Pepo macrocarpus*, the pumpkin or pumpkin, is originally from India, but is at present cultivated in most parts of Europe. It is one of the plants which acquires in the course of a single season dimensions of no ordinary kind. The stem, which is herbaceous, cylindrical, and hollow, sometimes attains a length of thirty or forty feet, and covers one-eighth of an acre. Its flowers are large, axillary, and of a fine yellow colour. The fruit is red, and acquires sometimes a diameter of two feet. There are two varieties of the plant, one with roundish, the other with oblong fruit. Its flesh is firm and has an agreeable taste; it is refreshing and slightly laxative, but is not used in medicine.

In England the pumpkin is occasionally planted

by country people on dunghills beside their cottages, and the fruit, when ripe, is hollowed out and stuffed with sliced apples, sugar, and spices, so as to form, when baked, what is called pumpkin pie. On the continent, both the unripe and ripe fruit is used in soups, and is fried in oil or butter. The tender tops of this and other species are boiled as greens. The seeds are employed in the same way as those of the cucumber and melon.

Cucurbita melopepo, melon pumpkin or squash, is another species of the genus which is cultivated in America as a culinary vegetable. It yields a large reddish yellow fruit. A variety of *C. ovifera*, called succade or vegetable marrow, is frequently cultivated for domestic use. It bears an oblong pale yellow fruit, which is either fried with butter or boiled and made into pies.

Cucurbita lagenaria, or more properly *Lagenaria vulgaris*, common calabash or bottle gourd, is found within the tropics, particularly in India, and yields an edible yellow fruit, having a whitish pulp. This fruit is sometimes six feet long and eighteen inches in circumference, and is called by the Arabians *Charrah*. There are several varieties of the plant, such as the common gourd, the depressed and the turbinated bottle gourd, the congourde, and the trumpet gourd. The name of bottle gourd is given to it on account of the shape of the fruit, and the use to which it is applied. In Jamaica and other warm countries, the dried outer coat or rind serves the purpose of water cups or bottles. The fruit is not often employed as an article of food, although it is tolerably good after being well cooked. The pulp is sometimes applied as a poultice, and the seeds are put to the same use as those of the genus *Cucumis*.

Gourds and calabashes are propagated by sowing their seeds in hotbeds in the month of April, afterwards transplanting them into beds with a moderate heat and plenty of moisture, and finally putting them on a dunghill and allowing them room to spread.

The genus *Momordica* is the next to which we shall turn our attention.

Momordica elaterium, wild cucumber, is a perennial plant found native in the south of Europe. It has been cultivated successfully in this country, but does not survive the winter. The fruit is oblong, about an inch and a half long, and an inch in thickness. It has a green colour, and is covered with thick rough hairs. When ripe, a slight touch separates it from the stalk, and the seeds and juice are scattered in all directions and with great force through the hole in the base where the footstalk was inserted. Hence the name *squirting* or *spurting cucumber* which has been given to the plant. The cause of this peculiarity in the opening of the seed vessel has not yet been fully ascertained, although many theories have been hazarded in regard to it. The seeds when fully ripe have a black colour, and are surrounded by a fluid from which the substance known in medicine by the name of *Elaterium* is produced. This drug is the fecula which subsides from the juice after the watery part is evaporated. In order to obtain it, the fruit is collected in the month of September before it is ripe, and is cut longitudinally, so as to allow the clear fluid to run out without pressure. By standing the liquid soon becomes turbid and deposits the elaterium, which is collected and dried without exposure to light.

When pure, elaterium should be in the form of thin cakes, of a light green colour, without any odour, and

having a bitter and slightly acrid taste. If it is nearly black, compact, and heavy, and breaks with a shining resinous fracture, it should be rejected as bad. It is often mixed with starch, an adulteration which it is sometimes not easy to detect by its appearance.

Elaterium consists of water, extractive, fecula, gluten, woody matter, and *Elaterine*. The latter substance, which is the active principle of the drug, was discovered by Dr. I. D. Monies, and is totally different from the *Elatin* of Dr. Paris. It is a white crystalline substance, of an extremely bitter taste, insoluble in water, but soluble in alcohol. It is easily procured from the alcoholic tincture of elaterium by evaporating it to the consistence of thin oil, and while still warm throwing it into boiling distilled water.

Elaterium is a powerful or drastic purgative, which is prescribed with good effect in cases of dropsy. It was known to the ancient physicians, and was used by them occasionally. When pure, it may be given in doses of one sixth or half a grain, and its effects should be carefully watched, as they are apt to be too powerful. Elaterine acts well in the dose of one-twelfth or one-sixteenth of a grain, and is much more certain than elaterium itself. The elaterium imported from Malta frequently requires to be administered in doses of two or three grains before it will act.

Momordica balsamina, balsam apple, is a native of India, and was introduced into Britain in 1568. It has a fleshy ovate fruit, which, when ripe, is of a red colour, and bursts irregularly so as to disperse the seeds. It is famous in Syria for curing wounds.

Bryonia is the only British genus of the order, and it contains a very large number of species, almost entirely exotic.

Bryonia dioica, red-berried bryony or wild vine, is frequent in thickets and hedges in England, but is scarcely indigenous in Scotland. It has a very large white root, and a slender climbing stem, and bears whitish flowers, which are succeeded by berries of a red colour.

The plant abounds in a fœtid acrid juice. The root has a disagreeable taste and decidedly purgative properties, which are not lost by drying. When applied externally to the skin, it causes redness, and if the application is long continued it will induce inflammation. It was much used in ancient times as a violent purgative in cases of dropsy and insanity. When dried and powdered, the root was administered in doses of thirty or forty grains. In the south of England it is still used as a laxative, after being infused in gin. It is not, however, employed to any extent now-a-days in medicine, in consequence of the violent and even dangerous nature of its action. In large doses it is an acrid poison, and produces death speedily.

Bryony root consists of resinous and gummy matter, starch, albumen, extractive matter, vegetable fibre, water, several salts, and a peculiar principle to which the name of *Bryonine* has been given. This substance has a reddish-yellow colour and an intensely bitter taste, and has been considered the active ingredient of the plant. It is soluble in water and alcohol, and appears to be analogous to *Cathartine*.

The fecula contained in the root of the bryony, when separated from the bitter principle, may be used as nutriment. Cooking has a great effect on the properties of the plant, rendering it wholesome and depriving it of its purgative qualities.

The root of *Bryonia rostrata*, beaked bryony, is prescribed in India internally in piles. It also possesses demulcent qualities, and has been recommended in asthmatic complaints.

The root of *Bryonia epigæa*, air-living bryony (so called from living in the air and throwing out shoots readily in that situation), was formerly considered as calomba root, which it resembles in quality.

The root of *Bryonia cordifolia* is reckoned cooling.

Bryonia callosa yields small bitter seeds, which are prescribed by the native practitioners of India in cases of worms, and also as a veterinary medicine. A fixed oil is procured from them, which is used for lamps.

It only remains for us to notice a few remaining genera, in order to complete the history of this important family.

The leaves of *Fenillea* or *Nhandiroba cordifolia* are said to be antidotes to vegetable poisons, even to such powerful poisons as strychnia.

The fruit of *Trichosanthes palmata*, palmate snake gourd, when powdered and mixed with warm coconut oil, is used in India for healing sores which occur in the ears and nostrils.

The fruit of *Benincasa cerifera*, wax-bearing gourd, is covered with a waxy substance, which is most abundant at the time when it becomes ripe.

Joliffia Africana or *Telfairia pedata* is an African plant yielding a fleshy fruit, three feet long and often eight inches in diameter. It is filled with seeds as large as chestnuts, which are said to have the flavour of almonds, and to yield abundance of oil equal to the finest olive oil.

CULICIDÆ. A family of dipterous insects, belonging to the section *Nemocera*, and having for its type the genus *Culex* of Linnæus, or the blood-thirsty gnat. This family occupies the foremost range amongst dipterous insects, on account of the more complete development of the organs of the mouth and antennæ. Indeed, it is not surprising; when we examine the structure of the gnat, that, even in the time of Pliny, this insect should have been selected as affording an admirable example of the wonders of the creation. "Ubi tot sensus collocavit ut in culice?" observes this father of natural history; and when we notice the beautiful organisation of the proboscis, that fearful organ which causes us so much pain, we immediately perceive its superiority, or rather the more complete development which it exhibits over the mouths of other diptera, except the *Tabanidæ*. This apparatus, although it appears to the naked eye like a long, slender, simple and single organ, consists, in fact, of a considerable number of fine lancet-like pieces, enclosed in a fleshy gutter, forming an instrument admirably fitted for suction, and provided with a poisonous liquid, which it instils into the wound it makes, and which is supposed to have the effect of causing the blood to flow more freely. Overlooking the beautiful organisation which this insect exhibits, how often is it that, in our rage, we destroy, or at least attempt to destroy, the gnat, which has feasted at the expense of our blood? How seldom is it that, like Reaumur, we have patiently allowed it to make its attack upon us, in order to watch the curious operation by which the blood is pumped up into its stomach from our hand. In every quarter of the globe, the gnat or mosquito, for the terms are nearly synonymous, does not cease day and night to attack us; and there is scarcely a spot on which they do

not abound. It has been considered by Isidore of Seville, that the name is a contraction of "*Cutilex*, quod cutem laciāt," an ingenious supposition, and one fully confirmed by the habits of the species. Nevertheless, this thirst for blood is exhibited only by the female; and in default of this fluid, this sex, as well as the males, content themselves with the honey of flowers. It would seem, also, that all the species are not similarly obnoxious, since Linnæus affirms that *Anopheles bifurcatus* does not prick with its proboscis. These insects seldom appear by day, except in dark woods, seemingly affected by the sun's rays. At twilight, however, they sally forth to pursue their blood-thirsty operations, and it is at this period that they assemble in swarms in the air for the purpose of coupling. Shortly afterwards, the females deposit their eggs in a very remarkable manner. The larvæ are destined to live in the water. The gnat is an aerial being. Taking its station, therefore, at the extremity of some floating leaf, the female deposits her eggs, one by one, attaching them together, and forming them, with the assistance of her hind legs, into a curiously contrived boat-like mass, which floats upon the surface of the water. These eggs hatch in the course of a couple of days. The larvæ considerably resemble those of some other *Nemocera* having aquatic larvæ (see *CHIRONOMUS*), differing, however, in several respects. The body is long, and furnished at the sides with long hairs; the head distinct and rounded, with two long ciliated jaws, which are kept in continual motion, serving for producing a current of water, which brings various small floating particles in contact with the mouth, which serve for the food of the larva; the mouth is also furnished with two long palpi, ornamented with whorls of hairs, and, with these exceptions, the body possesses no other distinct organs for locomotion; the last joint of the body is elongated, and furnished on one side with a long tube, placed at an angle, and enclosing a breathing apparatus. The extremity of this tube, and of the tail itself, is ornamented with a coronet of hairs, coated with an oily matter, and serving to repel the water; hence, when the larva takes its station at the surface of the water, for the purpose of obtaining a fresh supply of air, these hairs expanding, serve as a kind of buoy for retaining the insect in such position. These larvæ are small semi-transparent animals, which may be seen throughout the summer in ditches, or other standing water, jerking about with much rapidity. When the larva wishes to descend, it contracts the hairs of the buoys above mentioned, enclosing a bubble of air for future use in respiration. They are transformed into pupæ in about fifteen days; the front, or thoracic part of the body, is now thickened, and exhibits beneath the rudiments of legs and wings, enclosed in a general covering, and the hind part of the body curved towards the breast; instead of the posterior tube of the larva, its external breathing apparatus now consists of two anterior small horns, like those of the pupa of the chironomus. It jerks about in the water with much agility by the assistance of two small swimmerets, or little oars, at the extremity of the body, and two long hairs.

But, how is this aquatic animal, unprovided with legs or wings, able to creep along the sides of the bank, or up the stem of any growing plant, to escape out of the midst of the water, casting off a form which it could not live with in the air, and assuming one which would be destroyed if it remained in the water?

This question would puzzle any person but a naturalist. The pupa, rising to the surface at the period when it wishes to cast off its pupa skin, elevates the front part of the thorax above the level of the water, when instantly, by swelling the exposed part, the skin bursts, and the head of the gnat appears, followed by the thorax, which, from its increased size, enlarges the slit, so as to allow the rest of the body to follow with greater ease. At this critical period, the old skin of the pupa, which is of course now hollow in some places, serves as a support; in fact, it becomes in every sense a life-boat to the little animal. "The observer, who sees how the little boat gradually sinks, and how its margin approaches the water, forgets the mischievous insect it contains, which, at another time, he would crush without remorse, and becomes interested for its fate, especially should wind agitate the water. If it should upset, it would be all over with it, and numbers do thus perish. The gnat, after having fixed itself thus perpendicularly, *draws first its two anterior legs out of their case**, and moves them forward, and next the two intermediate ones; then, inclining itself towards the water, it rests itself upon it; for water is to them a soil sufficiently firm and solid for support, although surcharged with the weight of the insects; for, as soon as it is thus upon the water, it is in safety, its wings unfold themselves, and are dried, and it flies away. This is the work of an instant."—Introduct. to Ent. vol. iii. 288.



Culex pipiens, female, natural size, and magnified, with the head of the male.

The genera belonging to this family are *Anopheles*, *Culex*, and *Ædes*, founded chiefly upon the length of the palpi, together with *Sabethes* and *Megarhina*. The two first only are British. There are about twenty British species belonging to the genus *Culex* (including the type *C. pipiens*, Linnæus), and four belonging to *Anopheles*.

CULICIFORMES (Latr.) A division of dipterous insects, belonging to the section *Nemocera*, and family *Tipulidæ*, and comprising many minute species, generally called midges, having, as the name implies, great resemblance with the insects composing the family *Culicidæ*, or true gnats, but differing from them, in wanting a long and exerted proboscis, the mouth consisting only of two short dilated fleshy lips, and a pair of short palpi. The antennæ are much ornamented with whorls of hair, which, in the males, are often as long as the entire antennæ, and form beautiful objects. The ocelli are wanting, and the eyes are crescent-shaped; the body is long, and the legs slender, the tibiæ not being spined at the extremity. Here belong the genera *Tanypus*, *Chironomus* (which

* A recent writer has criticised the authors from whence we have extracted this passage, stating, that Kirby and Spence, by mistake, say it draws these out of their ease. (Ins. Miscell. p. 19.) Had he been aware that the legs of dipterous insects are inclosed in distinct cases, although sometimes closely applied to the body, he would not have been so rash. Compare Swammerdam, pl. 31, fig. 8, d, and pl. 41, fig. 4, d.

see), *Sphæromias*, and *Corethra*, Meigen. The latter genus is distinguished from *Chironomus*, by having the antennæ composed of fourteen oval joints in both sexes, the terminal ones being but little different from those at the base of these organs. The wings, when at rest, are laid horizontally upon the back. The type of the genus (which comprises but very few species) is the *Tipula culiciformis* of De Geer, by whom the history of this species has been traced through its different stages. Reaumur likewise found the larvæ of another straw-coloured species (*C. plumicornis*), in July and August, in standing water. Its body is crystalline and transparent, long, nearly cylindric, and rather thickened at its anterior part; the head is furnished in front with two recurved jointed hooks; and the tail is armed beneath with an oval plumed apparatus, for swimming or respiration, and at the tip with two hooks. The nearer this crystalline larva (which is a beautiful microscopic object) is to its transformation, the more distinctly four kidney-shaped bodies are perceived, two in the front part of the second, and two in the ninth segments of the body. It has been stated, in the *Insect Transformations*, that the latter perhaps serve to inclose the tail-fins of the pupa, and the former the horns of the pupa, which again encase the antennæ of the gnat (midge), both which statements appear to us quite untenable; because the tail-fins of the pupa, being attached to its terminal segment, would necessarily be covered by the terminal segment of the larvæ, whilst the antennæ are laid along the breast, the "antennæ cases," as they are miscalled, arising from the thorax. It is more probable that the anterior pair of these bodies may, as De Geer conjectures (vol. vi. p. 395), be air-reservoirs, which, when the insect assumes the pupa state, become external, and are transformed into the horns in front of its body. Moreover, analogy induces us to adopt this opinion, as the same organs are found employed in respiration in the pupa of the gnat. Like most larvæ, the one which we are now describing sheds its skin. In like manner, it seems clear, from the statement of Reaumur, that the skin is also cast on assuming the pupa state, as he found exuviae at the bottom of the glass in which he kept them. The pupa is oblong, with the thorax bulging out, and having two small horns placed upon the front of the back; the head is closely applied to the front of the breast, with the antennæ lying behind the eyes, and the legs placed along the breast, enclosed in short cases. The tail is long, and gradually tapering to the tip, which is furnished with two elliptic-shaped plates employed in swimming. In this state it is very active, jerking about with great agility, especially when the time for assuming the perfect state approaches. It, however, usually keeps close to the surface of the water, so as to be able to project the thoracic horns above it, so that they are exposed to the air, an evident proof of their being employed as organs of respiration. The insect remains in this state ten or twelve days, when it assumes the perfect winged state.

CULLUMIA (R. Brown). A genus of ornamental shrubs from the Cape of Good Hope, belonging to the order *Compositæ*. Generic characters: anthodium of one leaf, thickly set with scales. Receptacle favose, seeds smooth; pappus none. This plant is curious, and easily kept and propagated in green-houses under ordinary management.

CULTRIROSTRA, a sub-order of stilt birds, characterised by the bill being long, strong, and knife-shaped. It includes the cranes, storks, herons, and some of the allied genera. See BIRD.

CUMMINGIA (D. Don). An elegant, bulbous-stemmed plant, introduced into this country from Chili. Linnæan class and order *Hexandria Monogynia*, and natural order *Asphodeleæ*. Generic character: calyx, bell-shaped, six-cleft, nearly regular, spreading; stamens inserted in the base of the corolla; filaments very short, united in a ring; anthers forming a cone, with cleft processes at top; style awl-shaped; capsule three-celled, three-valved, with many seeds. This is the *Conanthera campanulata* of Ruiz and Pavon, and of several other authors. Three species are already known, and they succeed when managed like other tender bulbs, that is, planted in a frame or pit, or on a warm border; the bulbs to be taken up before winter, and planted again in February. They are increased by seeds and offsets.

CUMINIUM (Linnæus). An odoriferous plant, cultivated for its peculiar qualities as seasoning in cookery, and as a medicine. It belongs to the natural order *Umbelliferæ*. In this country it only requires sowing in the open ground, with other annual herbs.

CUNNINGHAMIA (R. Brown). A fine ornamental forest tree, introduced from China. It belongs to the class *Monœcia* of Linnæus, and to the natural order *Coniferæ*. This is the *Pinus lanceolata* of Lambert, and the *Belis jaculifolia* of Salisbury.

CUNONIACEÆ. A natural order of dicotyledonous plants, containing eight genera and forty-four known species. It is closely allied to *Saxifrageæ*, and by many botanists is considered merely a section of that order. It differs, however, in its shrubby habit and its remarkable interpetiolar stipules. It bears also an affinity to *Baueraceæ*, from which it is distinguished by its definite stamens and the presence of stipules.

The characters of the order are: calyx four or five-cleft, half superior; petals four or five, occasionally wanting; stamens eight to ten, perigynous and definite; ovary two-celled, the cells having two or many seeds; styles one or two; fruit two-celled, capsular or indehiscent; embryo in the axis of fleshy albumen. The plants belonging to the order are trees or shrubs with opposite, compound, or simple leaves, interpetiolar stipules, and white or red flowers.

They are found at the Cape of Good Hope, in South America, the East and West Indies, and New Holland.

Little is known in regard to their properties. The chief genera of the order are: *Cunonia*, *Wcinmannia*, *Callicoma*, *Dieterica*, *Ceratopetalum*, and *Arnoldia*.

Of the genus *Wcinmannia*, there are thirty-one known species, most of which possess astringent qualities: one of the species is used in Peru for tanning leather, and its bark is employed to adulterate Peruvian bark.

CUPANIA (Linnæus). A genus of lofty tropical trees, belonging to the eighth class and first order of the sexual system, and to the natural order *Sapindaceæ*. Generic character: calyx of five sepals; petals cupped or flattish; filaments awl-shaped; sometimes long, but frequently very short; anthers incumbent; style trifid; stigma obtuse; capsule leathery, and three-celled, three-valved; cells one or two seeded, seeds winged. This tree is cultivated

in our stoves, is grown in loam and moor-earth, and is propagated by ripened cuttings struck in sand, and a little heat.

CUPHEA (R. Brown). A genus of greenhouse, annuals, and hothouse under-shrubs, natives of the West Indies. Linnæan class and order *Dodecandria Monogynia*, and natural order *Salicariæ*. Generic character: calyx tubular, swollen at the base; limb from six to twelve-toothed, the upper tooth broad; petals six, inserted in the calyx; stamens from ten to fourteen, fixed to the throat of the calyx, unequal; anthers two-celled; style filiform; stigma simple or two-lobed, bottom of the ovarium glandular; capsule covered by the calyx, one-celled; seeds like lentils. The annual species may be sown in the open ground, like other annuals; and the biennial sorts should be raised on heat, put into pots, and kept in the greenhouse or stove.

CUPRESSUS (Linnæus). A genus of ornamental evergreen trees, commonly called cypress. They belong to the twenty-first class of Linnæus, and to the natural order *Coniferæ*. A few of this genus are kept and propagated and managed like other greenhouse plants. The hardy sorts are raised from seeds, and nursed in pots till fit to be planted on lawns or other parts of ornamented ground. When young they are tender, and liable to be killed by severe frost; but in favourable situations, as in the south of England, and in all warmer countries, they gain a considerable height, and are very conspicuous trees. They were anciently, as well as at present, in south-eastern Europe, chosen as memorials of the dead; and still are the principal ornaments of cemeteries in Greece and over all the Ottoman empire.

CUPULIFERÆ—The oak family. A natural order of dicotyledonous plants, containing five or six genera, and numerous important species. It is allied to the willow and birch families, but is distinguished from the former by the veining of its leaves, and from the latter by the presence of a calyx. It bears also an affinity to *Urticæ*, but differs in its many-celled ovary, pendulous ovules, and superior calyx. By many botanists this order is considered merely as a section of *Amentaceæ*. The name *Cupulifereæ* is derived from the peculiar husk, or cup (*cupule*), in which the fruit is enclosed.

The essential characters are: flowers unisexual; male ones amentaceous, with from five to twenty stamens, which are generally distinct, and are inserted into the base of the scales, or perianth; female ones aggregate, or amentaceous; ovaries crowned by the rudiments of a superior calyx, seated within a coriaceous involucre, variously formed, and with several cells and ovules, the greater number of which are abortive; ovules twin, or solitary, pendulous; stigmas several, nearly sessile, distinct; fruit, a horny, or coriaceous, one-celled nut, more or less enclosed in the enlarged involucre (*cupule*); seeds solitary, two to three, pendulous; embryo large, with plano-convex, fleshy cotyledons, and a minute superior radicle.

The plants belonging to this order are trees or shrubs, having alternate simple stipulate leaves, with veins proceeding straight from the midrib to the margin. They inhabit chiefly the temperate parts of the northern hemisphere, and form extensive forests both in the old and new world. They are common in Europe, Asia, and North America, and they are also found in some parts of South America, and in the northern parts of Africa. They are said to be

totally unknown at the Cape of Good Hope. Some of the species grow on the high lands of tropical regions.

The order furnishes many trees which are highly valued on account of their timber. Its medicinal properties in general may be said to be astringent and tonic, and it includes some plants which are used in the arts, and others which are employed as articles of materia medica.

The chief genera are, *Quercus*, or oak; *Castanea*, or chestnut; *Fagus*, or beech; and *Corylus*, or hazel nut.

The genus *Quercus*, or oak, belongs to the class *Monœcia*, order *Polyandria* of the Linnæan system, and is well known as supplying many important species of forest trees. According to Michaux, there are at least forty-four species of the genus in America, confined entirely to the northern hemisphere, extending from the 48th to the 20th degree of latitude; while in the old world there are upwards of thirty species, which grow both in the northern and southern parts, from the 60th degree of north latitude. The species have been divided by him into separate sections, according as the fructification is annual or biennial; and the different forms of the leaves have furnished him with a means of further subdivision.

Of all the species, the *Quercus robur*, or *pedunculata*, of some foreign authors, the common British oak demands our first attention, whether we consider the dignity of its stature, or the variety of uses to which it is applied. It is the king of our forests, excelling all other trees in the beauty of its growth, the thickness of its trunk, and the hardness and solidity of its wood. It constitutes the greatest part of the European forests, extending from the 60th to the 35th degree of latitude. It is indigenous in our island, and grows well in almost any soil, and even in the most exposed situations. It delights in rich deep earth, but the finest grained timber is said to be produced in sandy soils. It is found both in forests and hedgerows, but succeeds best in the former. The flowers appear in spring, but the exact time at which the leaves and flowers expand varies much, according to the situation and soil in which the tree grows. Sometimes we notice one oak in full leaf, and another, not far from it, without any such appearance, owing to the coldness or barrenness of the soil in which it has been planted. The leaves are generally put forth at a later period than those of other trees, but they continue longer green.

The oak is usually raised from its seeds, which are ripened in October, and well known by the name of acorns. These may be either sown at once in the place where the oaks are to remain, or in a nursery, and the young trees subsequently planted out. They are sown in the spring or autumn, in loamy well prepared soil, and the young plants generally appear above ground in the course of six weeks. If reared in a nursery, they may be planted out in the course of two years, and considerable care is necessary in keeping the ground clean, and free from weeds. The plants, in the first instance, are set in rows, four feet asunder, and two feet distant in the rows, and after twelve or fourteen years, every second plant is taken out, and sold for hoops, or small poles. After seven or eight years more, another thinning may be practised, the strongest and most vigorous trees being left to form timber at the distance of twenty or thirty feet from each other. The plantations should be

sheltered by means of Scotch fir, or other hardy quick-growing trees. On the judicious thinning and clearing of a young wood, as well as protecting it from the severity of the climate, depends much of a planter's success and profit. The oak might be cultivated very profitably on many waste lands situated near rivers or navigable canals. When the acorns are sown in a field, and the trees allowed to grow naturally, we secure the best timber for the use of the carpenter and ship-builder, and in a much shorter time than if the plants are first raised in a nursery, and then transplanted.

The oak attains a great age, and is said not to reach maturity till it is one hundred years old. Some of the aboriginal oaks of this country have been known to exist for a thousand years. The oak against which the arrow of Walter Tyrrel glanced, before it killed William Rufus, was in existence less than a century ago; and there is still seen at Torwood, in Stirlingshire, the oak under which the famous Wallace convened his followers.

The oak sometimes acquires the height of 100 feet, more especially when planted in woods. Its trunk also attains a great degree of thickness. The trunk of an oak growing in 1764 in Broomfield wood, Shropshire, was sixty-eight feet in circumference and twenty-three feet in length. The tree was estimated to contain 1455 feet of thick timber. The circumference of the green dale oak, near Welbeck, at eleven feet from the ground, was thirty-eight feet, and one growing near Wetherly, in Yorkshire, measured seventy-eight feet close to the ground. Dr. Thomson mentions that an oak was felled at Whitby Park, Shropshire, in 1697, which was nine feet in diameter without the bark; its branches spread 144 feet, and twenty-eight tons of timber were contained in the body of the tree. Dr. Plott mentions an oak, at Norbury, which was forty-five feet in circumference, and when it was felled and lying on the ground, a horseman on one side of the trunk was completely concealed from one on the other side.

While the tree thus attains a great height and thickness, it also sends its roots deeply into the ground, and is thus enabled to resist the shocks of tempests and the war of elements.

As o'er the ærial Alps, sublimely spread
Some aged oak uprears his reverend head,
This way and that the furious tempests blow,
To lay the monarch of the mountain low;
Th' imperial plant, though nodding at the sound,
Though all his scattered honours strew the ground,
Safe in his strength, and seated on the rock,
In naked majesty defies the shock;
High as the head shoots towering to the skies,
So deep the root in earth's foundation lies.

The oak is a very valuable forest tree, and is much cultivated on account of the timber and bark which it furnishes. Houses and ships, cities and navies, are formed of it. To it we are indebted not only for our maritime glory and commercial prosperity, but also for many of the ordinary comforts of life.

From a small acorn see the oak arise,
Supremely tall and towering to the skies!
Queen of the groves, her stately head she rears,
Her bulk increasing with increasing years!
Now moves in pomp majestic o'er the deep,
While in her womb Britannia's thunders sleep;
With fame and conquest graces Albion's shore,
And guards the island where she grew before.

The oak was held sacred by the Greeks and Romans as well as the ancient Britons. By the

Romans it was dedicated to Jupiter, and in former times Druidical ceremonies were frequently performed under its shade. The fruit of the oak was used in the early ages of the world as an article of food, and the failure of the acorn crop was considered as a cause of famine. Now-a-days acorns are given as food to hogs, squirrels, and the larger gallinaceous birds, and are said to have a great effect in fattening them. The root of the oak is beautifully grained, and is employed for many useful and ornamental purposes. All the parts of the oak are astringent, but the bark possesses this property in a remarkable degree, and is on this account used officinally. Oak bark is covered with a bluish-grey epidermis, and within is of a red colour. It is peeled in spring, when it is more astringent than in the later part of the season. Its astringency is owing to the presence of gallic acid and tannin, which exist in great quantity in the inner part of the bark. As a powerful astringent, it is given internally in powder, in doses of from two to six drachms. It may be used as a substitute for cinchona bark in the cure of ague, and has been administered to stop internal hæmorrhages and bleeding from the nose and mouth. The decoction of the bark is used as a gargle in relaxed sore throats, and as a lotion to indolent ulcers. An extract of the bark is also prepared for medicinal use.

The use of the bark in tanning leather is familiar to all, and its employment in the construction of hot-beds is also well known. The saw-dust of the oak is used in dyeing all the varieties of drab and the different shades of brown. An infusion of the bark with a small quantity of sulphate of iron is employed by common people to dye woollen stuffs of a purplish colour.

Acorns and their cups when roasted are administered either in the form of powder or infusion in cases of bowel complaint and passive hæmorrhages.

The only other British species of the genus is *Quercus sessiliflora*. The specific name is apt to mislead, inasmuch as the flowers in both species are sessile. In the common oak, however, the *catkin* is on a long footstalk, while in the present species it is nearly sessile. The timber of this species is generally considered inferior to that of the *Quercus robur*.

Quercus suber, the cork tree, is a tree about forty feet high, which grows in the south of France, in Spain, Portugal, Italy, and the north of Africa, between the thirty-fifth and forty-fourth degrees of latitude. Its leaves continue green till the middle of May, when they generally fall just before the new leaves appear. It yields oval acorns like those of the common oak, which are eaten by hogs with avidity. Its timber is heavy, hard, and compact, but not very durable. The tree is chiefly valuable on account of its bark, the external layer of which furnishes the light, elastic, and impermeable substance called *Cork*, which is applied to so many important uses. The bark is taken off every eight or ten years, and the trees will often live for 150 years, even though the process of removing their bark is repeated regularly. When young, the tree does not yield good cork, and the two first peelings are in general not fit for use. It is only when the trees are about forty years old that the bark becomes valuable. The stripping of the bark takes place in the months of July and August. Two incisions are made parallel to each other along the whole length of the tree, and then two others are made transversely at the extremities. The outer bark is then removed, care being

taken not to injure the inner cortical layer, otherwise no new bark would be produced. After being taken off, the bark is flattened by exposing its convex surface to heat and pressure. It is also charred on both sides, so as to close the transverse pores before being sold. The carbonised surfaces are seen in bungs and taps, but not in ordinary corks which are cut lengthwise. The bark gathered in France has been estimated as sufficient to form 119,000,000 or 120,000,000 of corks eighteen lines long.

Cork was used by the Greeks for sandals, and is occasionally employed now-a-days for lining the soles of shoes. It is also employed to form surgical instruments and apparatus, and is essential to the cabinet of the entomologist.

The charcoal got from it, when mixed with lard, has been recommended in piles. It contains a peculiar principle called *Suberin*, and an acid called *Suberic acid*.

Quercus tinctoria is an American tree which attains the height of eighty or ninety feet with a diameter of four or five feet. It supplies useful timber, and its bark is used for tanning leather. The cellular part of the bark furnishes *quercitron*, a substance used for dyeing wool and silk of a yellow colour. It is said to be superior to woad. The decoction of quercitron has a brownish yellow colour, which is rendered deeper by alkalies.

Quercus coccifera, the kermes oak, grows plentifully in Spain, Provence, Languedoc, and along the coast of the Mediterranean. It is a tree of small growth, being in general not more than twelve feet high. Its acorns are smaller than those of the common oak. From this tree is gathered the vegetable kermes, an insect with which the ancients used to dye their garments of a beautiful pink colour. Since the discovery of America, the *coccus cacti*, or cochineal insect, has supplied the place of the kermes.

Kermes is met with in commerce in the form of little red globular grains torn on the side where the animal adhered to the leaves or young branches of the oak. According to analysis it consists of yellow fatty matter, red colouring matter analogous to carmine; coccine, a peculiar animal matter, and various phosphates and muriates. The colour obtained from the kermes is said to be more fixed than that got from the Mexican insect.

Quercus esculus, cut-leaved Italian oak, is the small oak or phagus of the Greeks, and the *Esculus* of Pliny. It is a native of Spain and Italy, and was used by the Romans to form their civic crowns. Its acorns are sweet, and are frequently eaten by the poor in the South of France, who, in times of scarcity, grind them and make bread with the flour.

Quercus rubra, red oak, is a native of Virginia and other parts of North America. It extends far north, and grows to the height of eighty feet. It yields large acorns, which are eaten by wild animals, as well as by horses, cows and hogs. Its bark is employed for tanning, but its wood is not much used in building.

Quercus alba. White oak, so called on account of the whiteness of its bark; is a native of North America, where it reaches the height of seventy or eighty feet, with a diameter of six or seven feet. Its wood is considered in America preferable to any other sort for building, on account of its strength and durability. The wooden bridge which joins Cambridge and Boston, and which is nearly 3000 feet long, is supported by posts of white oak from fourteen to fifty feet long.

Its bark contains a considerable quantity of tannin, and an infusion of it has been known to cure ague. Its acorns are large, oval, and sweet.

Quercus virens. Live oak, found in Carolina and Virginia; yields small acorns, which are eaten by the Indians, and are used by them to furnish a sort of oil. The acorns of *Quercus ilcx*, evergreen oak, are mild and nutritive, and serve for food. The acorns of *Quercus agrilops*, a native of Spain and the Levant, where it is called *Velomia*, are imported as a dye-stuff.

Many other species of oak might be noticed, such as black oak, scarlet oak, willow oak, chestnut oak, laurel oak, dwarf oak, water oak, &c., most of which are cultivated either on account of their wood or bark; but it appears unnecessary to dwell longer on the subject, inasmuch as the properties of the oak tribe have been already sufficiently illustrated by the examples which have been adduced. Before, however, proceeding to treat of another genus, we shall make a few remarks on a disease to which the oak is subject, in consequence of the attacks of insects.

The leaves, flowers, and fruit of almost all vegetables are liable to be attacked by the insect tribe;

The flowery leaf
Wants not its soft inhabitant. Secure
Within its winding citadel the stove
Holds multitudes. But chief the forest boughs
That dance unnumber'd to the playful breeze,
The downy orchard and the melting pulp
Of mellow fruit, the nameless nations feed
Of evanescent insects.

In some cases their attack is followed by the production of a peculiar substance, which is turned to useful account in a medical or economical point of view, and of this we have an excellent illustration in the genus now under consideration. Upon the leaves of all the species of oak there are found globular bodies, to which the name of galls, or gall-nuts, has been given. They are produced by various small four-winged insects, denominated *Cynips quercusfolii*, or *Diplolepis gallæ tinctoriæ*, &c. The adult female insect is furnished with a long slender spiral sting, with which it punctures the stalk of the oak-leaf, and at the same time deposits a minute egg, and probably some irritating fluid. In consequence of the irritation which is produced by this wound, the sap is determined to the part, and the extravasated juice flowing around the egg soon forms a soft excrescence, which serves both for the shelter and food of the young insect. The tumour increases very rapidly, until a perfect gall is formed. The larva afterwards issues from the egg, assumes the pupa state, and then escapes as the perfect fly, by perforating the walls of the chamber in which it is inclosed.

The best galls are those which are gathered before the insect has escaped, and are denominated black, blue, or green galls, on account of their colours. There is of course no perforation in them, and on opening them we find perfect specimens of the fly. Those galls, on the contrary, which are collected after the fly has escaped, are called white galls, and are not so much esteemed, containing less astringent principle than the entire galls in the proportion of two to three.

The oak on which the finest galls are found is described by Olivier, in his Travels in the Ottoman Empire, as the *Quercus infectoria*, a small tree growing in Asia Minor. The galls are collected by the poorer inhabitants, and are exported from Smyrna, Aleppo, and various parts of the Levant.

Oak-galls have a round globular form, and vary in size from that of a pea to that of a hazel nut. They contain, according to Sir Humphrey Davy, tannin, gallic acid, mucilage, saline, and earthy matter. A remarkable difference exists between the chemical properties of the oak-bark and nut-galls, the latter precipitating tartar emetic and infusion of cinchona, which are not acted on by the former. Water dissolves all the active matter of galls. The solution for medicinal use ought to be prepared by simply infusing the galls in distilled water at the temperature of about 180°. In this way we procure all the gallic acid and tannin in solution, without a mixture of extractive, &c.

Galls are used in medicine, both externally and internally, as astringents. They are prescribed in the form of powder, infusion, tincture, or ointment. When administered internally, they are often mixed with aromatics, so as to render them more agreeable to the stomach. In this way they are used in India for the cure of intermittent fevers. The infusion is employed as a gargle for relaxed sore throats, and as an astringent lotion for ulcers, while the gall ointment is applied as a remedy for piles. The powder, in doses of ten or twenty grains, is perhaps the best form of administering this medicine. Some preparations made from galls are used as styptics, to stop bleeding from wounds, leech-bites, &c.

Galls are also employed in dyeing, and in the preparation of common ink. In allusion to the latter circumstance, it has been well remarked—"How infinitely we are indebted to this little creature (the gall-fly), which at once enables us to converse with our absent friends and connexions, be their distance from us ever so great, and supplies the means by which, to use the poet's language, we can

Give to airy nothing
A local habitation and a name!

When any salt of iron is added to an infusion of galls, a black colour is immediately produced, and it is upon this principle that ink is manufactured, this valuable liquid being merely a decoction of galls, sulphate of iron or green vitriol, and logwood, with a little gum, which is added to give it a consistence.

The galls formed on the common oak, *quercus cerris*, and other species, are small, and smooth and reddish, and are not applied to use.

The next cupuliferous genus to which we shall allude is *Castanea*, chestnut.

Castanea vulgaris, or *vesca*, formerly *Fagus castanea*, the sweet, or Spanish chestnut, is a beautiful tree, the trunk of which often acquires a great size. It is stately and majestic, rivalling the oak in magnitude and duration. It is common both in this country and on the continent. Its flowers appear in long spikes about the month of June, and its fruit, which is enveloped in a husk defended by prickles, is ripened in September or October. The nuts which it yields are familiar to every one under the name of *chestnuts*. The bark of the tree is remarkable for its deep and wide clefts, which seem to have furnished ideas for some of the ornaments in Gothic architecture. The chestnut is not so picturesque as the oak, but it is sometimes introduced into the paintings of the old masters, more particularly those of Salvator Rosa.

Chestnut trees are remarkable for the age and size which they sometimes attain. At Tortworth, in

Gloucestershire, a chestnut tree grew in 1766, which was said to be upwards of one thousand years old. It was fifty-two feet in circumference, and was known to have served for a boundary-mark in the reign of King John, at which time it was five hundred years old. On Mount Ætna, in what is denominated the third, or woody region, there is a gigantic chestnut tree, known by the name of *Castagno de cento cavalli*, or chestnut of a hundred horse, because it was said to be capable of sheltering one hundred horses under its boughs. It is believed to be some thousand years old. It seems to consist of five large, and two small trunks, which, in all probability, formed only one originally, inasmuch as there is no bark on the inside of the trunks, nor on the sides that are opposite to one another. The largest trunk is thirty-eight feet in circumference, and the whole five taken together measure one hundred and ninety-six feet round. Although the interior is entirely decayed, and there is a wide public road through it, still the tree bears foliage, and even produces fruit. A hut is built within the trunk for the habitation of those who are engaged gathering and preserving the fruit. Several other large chestnut trees grow on the sides of Mount Ætna.

Chestnut wood was formerly in great repute for building. Evelyn mentions, that most of the ancient houses in London were built of it, and that a large forest of chestnuts existed in old times in the neighbourhood of that city. The church of St. Nicholas, at Great Yarmouth, erected in the reign of William Rufus, is roofed with chestnut. The wood serves also for various economical purposes. It is used for palisades, and props for vines and hops, as well as for water-works. Pipes bored of it, and lying constantly under ground, are said to be very durable. The Italians make casks and tuns for wine from this wood.

Chestnuts are mentioned by Virgil and Pliny as excellent articles of food. They are constantly used as such in the south of Europe at this day. Dr. Hooker states, that in some parts of France he has had them served up for breakfast boiled in milk. They are farinaceous, and when boiled have a sweet and agreeable taste. They consist of fecula, gluten, very analogous to that found in grasses, and a saccharine principle. They are used for whitening linen cloth, and for making starch. They are much relished by deer and swine.

There are several varieties of chestnut in cultivation. One of these, with striped leaves, is considered very ornamental. The trees are raised from the nuts, which are carefully selected, and placed in seed-beds in the month of February. In these they are allowed to remain for two years, and are then planted in rows, two or three feet apart, and a foot and a half distant in the rows. In the course of four or five years they may be planted out. This treatment is adopted when it is wished to produce fruit in abundance. If, however, the trees are intended for timber, they ought to remain in the spot where the seeds were originally sown, being merely thinned out, and kept free from weeds. Some, however, disapprove of this method, and think transplanting the best mode of rearing the tree, whether fruit or timber be desired. The chestnut succeeds well in almost any soil, but thrives best in rich loamy land.

Castanea pumila, the Chinquapin, or dwarf Virginian chestnut, is another species common in the

American woods, and attains a height of twelve or fourteen feet. It is a hardy tree, and produces abundance of nuts. It is sometimes cultivated in Britain.

The next genus for consideration is *Fagus*, or beech. *Fagus sylvatica*, the common beech-tree, is abundant in forests in the south of England, but is rarely found wild in Scotland. It is a handsome and valuable forest tree, putting forth green leaves, many of which, more especially when the tree has been clipped, remain during the winter, and assume a brown colour—

The red leaf
Seared in autumn's breath, yet wearing well
A garb to hail the coming winter in.

The leaves, after they fall, do not readily decay, and are used by the country people in France in place of straw for their beds.

The tree is either planted in woods or hedgerows, and sometimes attains a considerable height. Beech woods are peculiarly dry, and agreeable for walking, and are eagerly sought by the botanist, on account of the many rare orchideous plants which they contain. The leaves of the beech appear in April, and the flowers are produced in May. They are succeeded by an angular fruit, the size of a filbert, commonly called *beechnut*, which is ripened in autumn. There are two varieties of beech, the one with dark red, the other with cut leaves.

The wood of the beech is hard and brittle, and is employed by cabinet-makers, turners, and wheelwrights. Carpenters' planes are made of it, and when split into thin layers, it forms scabbards for swords. The ancient shepherds carved their love verses on the green bark of the tree, and they used the wood for the manufacture of bowls.

No wars did men molest,
When only beechen bowls were in request.

Beech nuts are sweet and agreeable, and have been used for food. When dried and powdered, they have been made into wholesome bread. They enabled the inhabitants of the island of Chios to endure a memorable siege. When roasted, they are sometimes used as a substitute for coffee. By expression, they yield a thick oil, which may be kept many years without becoming rancid. This oil is used for seasoning in some parts of France; and in Silesia the poor people make use of it in place of butter. Swine are driven in autumn into beech forests to feed upon the mast. The beech tree is propagated from seeds, and is treated in the same way as the oak and chestnut. It delights in a chalky and stony soil, and, when fully grown, affords an agreeable shade, as is beautifully noticed by Virgil in his First Eclogue. (For further particulars in regard to the cultivation of this tree, see article BEECH.)

Another genus, which is sometimes included under this order, is *Corylus*, or hazel. *Corylus avellana*, common hazel nut, grows abundantly in hedges and copses in all parts of Britain. It flowers early in spring, and ripens its fruit in September. The nuts, which are known by the name of filberts, are sweet, agreeable, and nutritive, and are common at our tables. Of the several varieties, the frizzled filbert is the best. The nuts contain a thick fixed oil, and are sometimes made into emulsions. The wood is used for various domestic and agricultural purposes. It forms good charcoal for drawing.

The young forked twigs of the tree constitute the celebrated divining rod, which, in the ancient days of superstition, was employed to indicate the part of the soil in which metals and springs of water existed.

The hazel is generally raised from seed, and, in order to produce fruit abundantly, it is regularly pruned, and not allowed to attain a great height. The name hazel-nut is derived from two Anglo-Saxon words, *hasel*, a cap, and *knutu*, a nut. (We have already given a short notice of this tree under the article BETULINEÆ, in which order it is included by some authors.)

The members of this family bear a very strong resemblance to each other, both in their botanical characters and medical properties. In all of them the bark is bitter and astringent, and is used for dyeing, tanning, or for medical purposes. The wood is, in general, employed as a durable timber for building. While, in a few instances, the fruit is bitter and disagreeable, in the greater number it is farinaceous, and frequently contains an oily matter used in domestic economy. There are no poisonous plants in this family.

CURASSOW, or HOCCO—*Crax*. A genus of gallinaceous birds belonging to the family ALECTORIDÆ, under which some account of the characters of that family, and a list of the genera which compose it, will be found.

The generic characters of the present genus are: the bill strong, of mean length, compressed, higher than broad at the base; the upper mandible elevated, arched, curved from its origin, which is enveloped with a membrane; nostrils basal, lateral, and partly closed with membrane; head ornamented with a crest composed of feathers which are erect, but recurved at their points; tarsi long and without any spur; three toes to the front united at their bases by a small membrane, and one toe to the rear which reaches the ground in walking; wings short, concave, and rounded; the sixth quill being the longest; tail composed of twelve large feathers.

The *Alectoridæ* occupy the same place in the natural history of tropical America, which the *Gallinæ* do in that of tropical Asia; and among them the genus *Crax* answers to the genus *gallus*, or common domestic poultry. They are found only in the rich forests of South America, and are more equatorial in their habits than the turkeys, though in their localities the two genera border upon each other, and, of course, to a certain extent occupy the confines of each other's ground. Like the jungle fowl of the east, the Curassows (*Hoccos* is the preferable name, for Curassow is the trivial name of only one variety, and it is not a very happy one, being derived from the island of Curaçoa, in which we believe the birds are not found) are all perchers; though they all seek their food upon the ground. Like these, too, they are very impatient of rain, and their plumage is soon wetted; in fact there is in their whole economy a very great resemblance to the fowl of the east.

That the principal ground-feeding birds of the two most fertile regions of the world, which have nearly the same latitude, but are almost the antipodes of each other in point of longitude, should correspond so nearly in their general habits and economy, is an important point in natural history; because it establishes the connection which there is between the region and the inhabitants. It also lets us see why the gallinaceous birds of those rich tropical countries

which have strongly marked varieties of seasons, should be different from those of more temperate climates, and also of the more elevated and exposed places of the same climates. The gallinaceous birds which are indigenous to the latter situations, generally squat and nestle on the ground during the night as well as in nesting time; while those of the tropical forests are invariably perchers, have their wings short, broad, hollow, and rounded at the extremities, and their tails large and strong; so that, though they are not adapted for long flight, there are no birds which get more quickly or more easily on the wing, or fly more nearly in the perpendicular. This is necessary, in consequence of the greater abundance of enemies which these birds have on the ground than the birds of open places; and it is also necessary that they should perch, because during the rains the ground is often laid under water for several days.

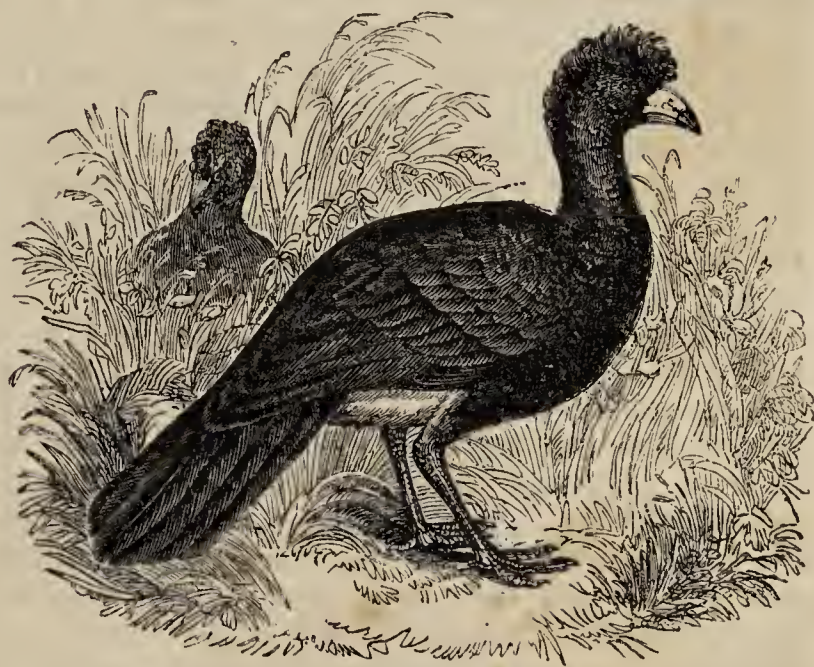
In a wild state the curassows inhabit the most remote places of the forests, carefully shunning the settlements of the colonists and the huts of the natives; but though they are retired they are so far from being shy, that they fall an easy prey to the sportsman. There are, comparatively speaking, few birds of prey, in those close places, because there is no scope for their wings; and therefore the usual safety of the curassow is gaining a branch. Thus when the sportsman comes before a pack of them, for they are sociable and live in considerable packs, he can shoot as many as he chooses.

Like the corresponding races of the east, these birds seem to tell man in as plain language as nature can speak to him, that the places which they inhabit were made for him to cultivate, and that they themselves were made to live with him in a state of domestication. For, as soon as they are brought into the farm-yard, they become as confiding as they are timid when in a state of nature. They breed freely, have no disposition to wander, fatten well, and are very valuable for the table, as well for the quality as the quantity of their flesh. When in a state of nature, they are not nearly so prolific as our domestic poultry, the eggs in a hatch being only from four to six; but we believe that in all the species there are two broods in the year. There are, however, no animals, the fertility of which is so much affected by treatment as domestic birds, more especially poultry; and the number of eggs which a domestic hen will lay, even in the cold countries of Europe, is far greater than that which a wild hen of the very same species will lay in the jungles of South-eastern Asia. As household poultry the present genus of birds are very successfully cultivated in South America; but the attempts which have been made in Europe have not been so successful; so that the birds are rarely seen except in single specimens in the collections of exhibitors. What the cause of the failure may be is not very well known; and it is rather singular that the cultivation of them should fail, while the pullet and pea-fowl of Asia, the Guinea-fowl of Africa, and the Turkey of America, all thrive so well. We believe, however, that there is something in the quickness of the transition; for the Asiatic and African birds have come gradually, and were centuries on their march from their native localities to the west of Europe. The Turkey, though a much more northerly bird, was at first exceedingly difficult to rear; and, we believe, that it is still the most tender chick in the poultry-yard; and it is natural to suppose that if a bird of the

comparatively temperate parts of America is thus delicate, one of the tropical parts must be much more so. It is also probable that as, hitherto at least, those who have visited the native abodes of these birds, have had neither taste nor skill in natural history, we may be ignorant of some circumstances which prevent this very valuable addition from being made to the birds of our farm-yards. The principal disease which these birds have displayed in the attempts to rear them in Europe, has been a sort of mortification in the feet; but whether that has been caused by food or by locality has not been ascertained. In a state of nature, the birds are found on ground both hard and soft; and they make their nests indiscriminately on or under hillocks, in rifts of the rocks, and on the forks of thick branches of trees; so that it is not easy to draw any conclusion as to what sort of locality would suit them best. Their history deserves to be studied much more carefully than it has been, and more with a view to domestic economy than to mere systematic natural history. There are several species, of the leading ones of which we shall give a list; and as each of them has either two or three English names, or none, we shall give precedence to the systematic ones.

CRAX CARUNCULATA—Wattled Curassow. This species is found in Brazil. It is a large bird, from two feet and a half to three feet in length. The upper part black with green reflections, the belly brownish, and the bill and feet black. The upper mandible of the bill is much elevated, and furnished at the base with a red membrane, which descends at each side a little below the under line of the lower mandible. It is from this that the bird gets its name.

CRAX RUBRA—Red Curassow. This is also a Mexican species, if, indeed, it be a species, and not a mere variety of the other. It is nearly of the same size as the former, and almost the only difference between them is in colour. The upper parts and the breast are of a red colour, marked with darker spots of the same; the head and neck are white, with a round black spot at the point of each feather; the feathers which form the crest are white with black borders; the under parts reddish; and the bill and



Red Curassow.

feet blackish ash. The young are mottled with white and black, and reddish, and have the black and the white on the head and neck reversed; the feathers of the crest straight, and the quills margined with white.

CRAX ALECTOR—Crested Curassow. This is the species which is generally referred to as being typical

of the genus ; but it is not so any more than the others ; and it is not more crested than they are, only its crest consists of feathers which are straight or nearly so, and broad at the tips, while in most of the other species those of the old birds are frizzled. We may remark, *en passant*, that the use of the crest to these birds seems to be to protect their eyes from the beams of a nearly vertical sun, which otherwise would prevent them from finding their food. The upper part of this species is streaked with white and reddish ; the breast, the belly, and the thighs are bright russet-red, crossed by black bands ; and the rest of the under parts entirely russet ; the bill is whitish, and the feet reddish ash. These are the colours of the young birds before they attain their full size. The native birds are entirely black on the upper part, with iridescent reflections ; pure white on the belly and under tail coverts ; but the colours are subject to variation. The bill and feet are blackish, the membrane of the bill and the naked space round the eyes blackish yellow. The size is rather less than the former species, though as domesticated there are great differences.

CRAX GLOBICERA—Lumped Curassow. The distinguishing character of this species is, a round protuberance or knob on the upper mandible, immediately in front of the membrane. The upper part, and indeed the whole plumage with the exception of the belly, the lower tail coverts, and the tips of the wing coverts, all of which are pure white, is black, with various reflections. The membrane at the base of the bill yellow, the bill and feet black. The young have the prominence on the upper mandible very small, and streaked and mottled with black and white.

Such are the leading species or varieties, as usually noticed by naturalists ; but it is doubtful whether these be any more than mere climatal varieties ; for we believe that they all breed readily with each other ; they are all nearly of the same size, and their manners are exactly similar.

CURATELLA (Linnæus). So called because its rough leaves are used in Guiana for polishing wood. The genus belongs to *Polyandria Digynia*, and to the natural order *Dilleniaceæ*. Generic character : calyx of four or five sepals, persisting, sepals roundish, unequal ; petals rounded, hollow ; stamens inserted in the receptacle : filaments like threads ; anthers roundish, bursting inwardly. Style filiform ; stigmas headed ; capsules two, of two valves, hairy, one-seeded ; seeds oblong and naked. This plant is met with in our stoves ; is grown in sandy loam, and propagated by ripened cuttings.

CURCULIGO (Gaertner). A genus of tropical herbs, belonging to *Hexandria Monogynia*, and to the natural order *Hypoxideæ*. Generic character : flowers bundled, somewhat spiked, and bracteate. Corollas with tube slender, to which the styles are united, limb regularly six-parted, spreading ; stamens fixed to the corolla ; filaments slender, erect ; anthers oblongly linear ; style cylindrical ; stigma a three-lobed head ; berry longish. These plants thrive in loam and moor earth, and are increased by suckers, which rise from the root.

CURCULIONIDÆ (Leach). A very extensive family of coleopterous insects, belonging to the section *Tetramera*, and sub-section *Rhyncophora*, being generally known by the English name of weevils, and corresponding, for the most part, with the Linnæan genus *Curculio*. The frontal elongation of the head

into a snout, or rostrum, at once enables us to distinguish them from all other beetles. The *Bruchidæ*, it is true, have this part of the body produced in front, but it is very short in these insects, and cannot indeed be called a rostrum ; moreover, the parts of the mouth are very distinct in the *Bruchidæ*, and their antennæ are filiform, or thickened ; whereas, in the weevils, the mouth is exceedingly minute, and placed at the extremity of the rostrum, with the palpi scarcely visible, and of a conical form. From some of the wood-boring insects (*Xylophaga*, *Bostrichidæ*, and especially *Scolytus*), the less cylindrical form of the body, and the greater elongation of the rostrum, will serve to distinguish the curculionidæ.

When we consider “ what dire events from trifling causes spring,” and find the truth of this line confirmed in a thousand different ways by the agency of the minute objects of the creation, we may perhaps be not greatly surprised that the weevils (although furnished with a mouth, the various organs of which are so exceedingly minute, as to be apparently incapable of causing much detriment) are amongst the greatest enemies to the vegetable stores of mankind found amongst insects. Hence, there are no species so interesting in their economy, and so well worthy of being investigated in their different states, as some of those under consideration, since it is evident that it can only be by a positive acquaintance with the various times and places in which these creatures pass through their various states that we can ever hope to arrive at certain remedies against their attacks. We have already, in our article *CALANDRA*, given an account of the ravages of one of the most destructive insects in the family, viz., the corn weevil, and shall not therefore, in the present instance, enter further into the details of the habits of that particular group.

The great extent of this family, together with the minuteness of many of the species, render it very difficult to arrive at a knowledge of the various individuals of which it is composed. In the former respect, this group offers another curious instance of the great increase in our knowledge of the insect world, in addition to those which we have mentioned in former articles. At the beginning of the present century, Latreille stated that the family contained 800 or 900 species ; Dejean, in 1821, gave 1073 ; and Schœnherr, in 1833, 3544 ; since which many others have been discovered ; so that, in twelve years, the number of species has been more than tripled.

The European species of this family are, for the most part, of small size. Amongst these may be mentioned the genus *APION* (which see) ; but the Indian and Brazilian species not only acquire a very considerable size, but are adorned with the most splendid colours. The diamond beetle (*Entimus imperialis*) may be cited as the best known example. This insect is of very common occurrence in the country which it inhabits, and is brought to Europe in great numbers ; but opticians and others, who prize it for its splendid appearance, often demand high prices for large specimens. We have observed, that the most brilliant mode of examining this insect is to hold it near a candle, the light being between it and the eye, and then look at it with a lens of about three or four inch focus, when the effect is inconceivably rich and metallic.

The insects of this family are found in all climes ; but the same cause which induces an increase of size

in the tropical species, operates also in producing a much greater extent in the number of species. This cause is found in the nature of the vegetation of those regions where, from its continued growth and vast luxuriance, the herbivorous insects are more numerous called into existence to support the regular operations of nature.

Many of these insects are also singularly formed, and of very varied colours; the latter character is, however, of a transient nature, depending on the presence of minute scales or powder, with which the body is covered. Of these, very common examples may be observed in the splendid little green species found so abundantly in the spring on the nettles. The slightest touch, however, removes these beautiful ornaments; so that, unless the entomologist secures them soon after their appearance in their beetle form, all their beauty will have vanished. Hence it has been fancifully said that the curculionidæ are the lepidoptera of scale-winged insects. Like the lepidoptera, also, their rostrum is tubular, elongated, and capable of being placed in a groove or cavity for its reception on the underside of the front of the body. The larvæ of both also feed on vegetables, and these larvæ in both are of a totally different form from that of the perfect insects, so that we may regard this as an instance of one of those curious rules which seem to exist throughout the animated kingdom, which Latreille thus stated more than thirty years ago:—"Nature, in general, has a certain number of models which she re-exhibits ('reproduit'), with certain modifications, in all the classes, and even in the different orders of beings." This principle, which some of our leading naturalists of the present day have held forth, at very great length, as a novel idea, is certainly an interesting mode of viewing nature, even should we not feel inclined to regard it as entitled to so much weight in regulating our classifications of the animal kingdom as some of these authors have been induced to give to it. We will, however, defer to some more convenient opportunity our observations upon the nature of those affinities and analogies which unquestionably exist throughout nature.

In their habits, the curculionidæ exhibit all the symptoms of natural weakness. Of all beetles, they are provided with the least available means of defence, and are consequently the most fearful, avoiding both the light and noise; even the diurnal species are generally to be seen in a state of inactivity, their colours, resembling those of the substances upon which they are often found, also favouring their security. Unlike the majority of insects, if they are attempted to be seized, instead of unfolding their wings and flying away, they merely fold up their legs and antennæ, counterfeiting death, and falling to the ground. A few of the smallest species (forming the genus *Orchestes*) are more active, the large size of their hind legs enabling them to escape, by leaping to a very considerable distance, in a manner similar to that of the turnip beetle, and other species of the genus *Haltica*.

It is not often that these insects make use of their wings; indeed, many of the species are destitute of these organs, their wing-covers being in such cases soldered together. They also creep but slowly, but the underside of their tarsi is furnished with a kind of cushion, enabling them to retain their hold upon different objects in all positions.

It is in the larva state that the curculionidæ are the

most obnoxious to mankind; in the perfect state they can take but little food, and their chief care is, then, the propagation of their race. Their larvæ, like those of the *Cerambycidæ*, are fleshy, with their legs rudimental, or entirely wanting; but those of the *Curculionidæ* have the body more or less cylindric, with the extremities somewhat narrowed, so as slightly to resemble a spindle. The head is horny, and furnished with a pair of powerful jaws, and other organs of a fleshy nature. The nutriment taken by these larvæ is very diversified, those whose organs of nutrition are most robust attacking the harder parts of vegetables; thus the larva, which is termed the palmiste, being the immature state of *Calandra palmarum*, gnaws the trunk of the palms. Other larvæ, whose mouths are less powerfully constructed, feed upon the farinaceous matter of various seeds, or the pith of various plants, while others devour the leaves and flowers. A few of the more minute sorts are miners, eating only the parenchyma of leaves. And here we may mention a circumstance, tending to show the incorrectness of the opinion, that those species of insects which feed upon imported plants are not indigenous to this country. The hollyhocks in our garden have, for several years, been much injured by the small grubs of one of these insects, which we have ascertained, by rearing them, to produce the *Apion radiolum*, a species ordinarily nourished upon the mallow, but which, in this instance, has preferred the hollyhock, probably from its larger size, although mallows were growing within a very short distance from the hollyhocks. The instinct of the parent insect induces her to deposit her eggs in such situations that the larvæ, as soon as hatched, find themselves in the midst of their natural food.

We must refer to our articles upon *APION*, *BALANINUS*, *CALANDRA*, and other genera, for additional observations upon the natural history of these insects.

The beautiful *Rhynchites Bacchus* (termed by the French agriculturists *La bêche*) does great injury in the vineyards, appearing in June, and devouring the young and tender shoots, extracting the sap by means of its long tubular proboscis. This causes the leaves to roll and shrivel up, and in the midst of these rolled-up leaves, surrounded by a silken covering, the eggs are deposited, from which are produced the larvæ, which also devour the leaves. An ingenious mode of destroying these insects has been adopted in France, which we think might be employed with much success in our own country in killing various obnoxious insects, especially those which attack trained plants. The insect, when disturbed, adopts the general mode of defence pursued by its tribe, folding up its legs, and falling to the earth, so that, by holding a small gutter of paper beneath the branch, and then shaking the latter, the insects, being at the time on the point of depositing their eggs, drop into the paper gutter, and are easily destroyed.

Another species of this family, *Lixus paraplecticus*, attacks the *Phellandrium aquaticum*, the larva boring into the stems; and it is asserted by some authors, that horses, which feed upon the infected plants, are subject to a violent disease, which the Swedes term *stakrå*.

The thistle, *Carduus spinosissimus*, nourishes another weevil, whose virtues were highly praised in past times as a specific against the toothach. This insect, accordingly, acquired the name of *Curculio antidontalgicus*;

and it was said that, if fifteen larvæ of this species, or fifteen of the weevils, immediately after their arrival at the perfect state, were rubbed between the fingers till all the moisture was gone, these fingers would acquire the power of causing a cessation of pain, on touching the affected teeth, for a period of twelve months, notwithstanding all the washing which they might undergo. Truly, our forefathers were not a whit less gullible than their posterity of the present day. When full grown, many of these larvæ enclose themselves in cocoons of silk, which, in some species, closely resemble net-work, with open meshes.

The great Linnæan genus, *Curculio*, has been from time to time divided, by different authors, into various other generic groups, into the details of which it would scarcely be thought profitable were we to enter. This may be conceived, when it is stated that Schœnherr has increased their number to 288. We shall, therefore, content ourselves with giving a slight sketch of the distribution of the chief subdivisions into which the group is arranged, taking it in its extended limits, and embracing the *Attelabides*, *Brenthides*, and *Bruchides*, which, together, constitute the sub-section *Rhyncophora*.

1. Antennæ not elbowed at the extremity of the basal joint; rostrum without lateral gutters, for the reception of the basal joint of the antennæ (ORTHOCERI).
 - * Upper lip distinct; palpi filiform, or thickened at the tips.
 - a Antennæ thickened at the tips (*Anthribides*).
 - b Antennæ filiform; rostrum broad (*Bruchides*).
 - * * Upper lip not visible; palpi short, conical.
 - a Antennæ filiform, with the last joint alone forming a mass (*Brenthides*).
 - b Antennæ, with the three or four last joints, forming a mass (*Attelabides*).
2. Antennæ elbowed at the extremity of the basal joint, which is generally received in a gutter at the sides of the rostrum (GONOCERI).
 - * Rostrum short; antennæ inserted near its extremity (*Brachycerus*, *Curculio*, *Hypera*, *Liparus*, and a very great number of other generic divisions).
 - * * Rostrum long, with the antennæ inserted near the middle of this rostrum. This division nearly corresponds with the genera *Lixus*, *Rynchænus*, and *Calandra* of Fabricius, from which a great number of generic and sub-generic divisions have been detached.

CURRANT, is the *Ribes rubrum*, &c. of botanists. It is a native of Britain, and has been long cultivated in gardens, and no domesticated plant repays the care and trouble bestowed on it more than this. It is not only a most agreeable and wholesome table fruit, but its pulp and juice are convertible into many excellent confections, and sparkling wine, little if at all inferior to many sorts manufactured from the grape itself.

The currant, like all its alliances, are usually and easily propagated by cuttings. These should be chosen from among the most healthy and moderate-sized shoots of the previous summer; not those rankly luxuriant ones which sometimes rise from the root, nor the slender, dangling growths of the top.

The regular form of the future tree depends much on the proper choice and preparation of the cuttings. They should be from twelve to fifteen inches in length, after the knobbed part of the base, and slender points are cut off. All the buds on the lower part of the cutting should be carefully pruned off, leaving only four or five at the top, and which are destined to form the first branches. The cutting thus prepared is dibbed firmly into the ground, about five or six inches deep, as will allow as much for a clear stem, surmounted by the branches, at a due height above the surface of the ground. The cuttings may be planted either in autumn or in early spring, at a foot distance from each other, and on a rather shady spot of rich soil. Here they will not fail to prosper, seldom miscarrying, except from extreme drought, or by insects which destroy the foliage and points of the shoots.

The young plants will require no care during the first summer, nor till they want pruning in the following winter. At this first pruning some little skill is necessary in using the knife, in order to get the tree into good form. If the cutting has produced five shoots, the centre one had better be entirely removed; the four remaining (or if there be only three) will be enough of principal branches whence other shoots will be produced to form a head. The most desirable form is that of a cup; the middle being vacant, and surrounded by the fruit-bearing branches at about nine inches apart from each other. This is to be understood of the tree when it has arrived at its required height; because this form is gradually attained by the assistance of the pruner, in the following manner:—The first shoots are at the first pruning cut down to one-third of their length; these in the following summer produce a number of other shoots, some of which are reserved to fill up and complete the form, and the rest are pruned down to about an inch, to serve henceforth as a fruit-bearing spur. Thus the tree becomes annually enlarged till it has arrived at its full size, by which time all the primary and secondary branches will be also furnished with spurs.

These spurs yield the fruit and also a birth of shoots every year, which latter are spurred down at the winter pruning. This treatment is, or may be continued for half a score of years, if necessary; only occasionally cutting away old or worn-out branches, and training up young ones in their places.

But there is another way of pruning currant-trees which may be described in a few words:—no spurs are allowed to remain on the old branches, but instead of them a select number of summer shoots are reserved; and which, in consequence of their fewness, grow strongly. These at the winter pruning are reduced only one-third of their length; and the fruit produced from these shoots are invariably larger and finer than those produced from spurs. This last-mentioned method of pruning is eligible where quality is chiefly regarded; and the spurring mode where quantity is the object.

It has been a question whether or not it be expedient to divest the trees of their summer shoots while the fruit is swelling. Those who practise this process assert, that it assists to enlarge both the bunches, and berries, and also, by admitting the sun's rays, heightens the flavour. This is quite feasible, as the same thing is practised on the grape-vine; but a partial application of the knife in this case is always productive of the best results.

The best varieties of the currant are the large Dutch

* We have altered Latreille's arrangement, by bringing the *Attelabides* into connection with the *Gonoceri*, the interposition of the *Brenthides* not appearing to us to be so natural as that given above.

white, the common white, large red, long-clustered red, the large Champagne, and the white crystal. They all delight in rich loamy soil ; but will succeed any where if the ground be deep, moderately manured, and somewhat sheltered.

The black currant is a distinct species, and also a native of Britain. It is cultivated and increased by cuttings, as are the foregoing ; but the method of pruning is somewhat different. Young plants are permitted to throw out ten or twelve branches from the top of the stem : these are allowed to rise to the height of three or four feet without cutting back. From the lower parts of these many shoots are produced annually : these bear the fruit and only require thinning, none of the young shoots ever being topped. As a constant succession of fruit-bearing shoots rise from below, the topmost ones which have risen too high, are cut out to allow the lower shoots room, and by this means the tree acquires its due form and requisite height.

All the currants may be trained to walls or as espaliers : in which situations they are most conveniently covered from birds and insects, and preserved for table a month or two after the regular season of such fruit.

CURRUC A (Auctorum), Warbler. A genus of small fruit-eating and insectivorous birds, belonging to the *Dentirostral* order, and *Sylviadæ*, or pettychaps family, and of which the common blackcap (already described in its alphabetical situation) may be cited as a typical example. The bill, in the more characteristic species, is rather stoutish, at least for birds of this family, and is somewhat compressed ; the gape almost smooth ; the nostrils basal, lateral, oval, and exposed ; wings with the first quill-feather very short, the second inferior to the fifth, and the third and fourth generally the longest ; legs having the tarsi longer than the middle toe ; toes short, and formed for perching ; hind toe strong ; the sole dilated and broad ; claws much curved, grooved at the sides, and very sharp, that upon the hind toe strongest, and of greatest length.

This is one of the numerous and very distinct natural divisions which were formerly brought together and included in the immense Linnæan genus *Motacilla*, a huge and incongruous division, which was first reduced by Dr. Latham, who restricted that term to the wagtails, properly so called, but who again confounded, in his most comprehensive genus *Sylvia*, every small bird of a certain size which agreed in possessing a comparatively small and slender bill, however in other respects dissimilar. That designation also, in its turn, has now been limited to a particular group, the members of which exhibit some degree of resemblance in all their characters, and which therefore forms a most natural division ; and the nightingales, the wheatear, the redstarts, the accentors, the aquatic warblers, wrens, goldcrests, and a host of others equally dissimilar (including the present group), all of which were formerly arranged together under the one name *Sylvia*, are now distributed into various independent genera, each known by a separate name, and distinguishable by well-marked and obvious characters.

There are three principal divisions of European warblers, that is to say, of small, soft-billed, mostly migratory, insectivorous birds, which chiefly seek their food about the foliage of trees and bushes ; for the term *warbler*, as usually and technically applied in

works on natural history, has little or no reference to the vocal powers of these birds, a few species which excel in song having imparted this name to the whole group of which they are members. If we set aside, in the first place, the different wagtails and pipits ; secondly, the robin and wheatear tribe ; and thirdly, the different titmice and allied genera, each of which forms a very natural sub-family of the *Sylvianæ*, we have still, apart from the flycatchers and other tribes which usually take their insect food upon the wing, three leading subdivisions of small, migratory, arboreal, and insectivorous European birds, each of which contains a considerable number of species, and which, together, constitute what is called the *Sylviadæ*, or typical sub-family of the *Sylviadæ*. The first of them, comprising what are commonly called the different "willow-wrens," a number of little delicate birds with green plumage, and peculiar in their form and characters, will be fully described in the article SYLVIA ; the members of the second, which are inhabitants of aquatic situations, breeding among the reeds, willows, and sedges, and which are in other respects very different from the rest, will be mentioned under the generic head SALICARIA ; and the third, the *Sylvan*, or fruit-eating warblers, as they are appositely termed, a most natural group, now generally recognised under the name CURRUC A, are the birds we are now about to speak of. These three generic divisions, with one or two exceptions only, comprise the whole of the European species, which, in books on natural history, are usually denominated "warblers." We would restrict the term altogether to the last mentioned genus.

The most typical of the fruit-eating warblers are inhabitants chiefly of woods and thickets, orchards and gardens, some of which are less so, however, being found more along the hedges. They are all songsters, and most of them warble for a long time continuously, raising their voice as they proceed, and some of them invariably terminate with a loud and liquid flow of pleasing melody. They are mostly migratory birds, some of them being found in summer as far north as Lapland ; but none are known to occur in winter, even in the most southern of the European countries, except as stragglers ; a few of them, however, in the north of Africa, are more stationary. They feed upon various insects (more or less, according to the species) ; and they are very expert at capturing the winged ones as they fly by, but they never dart after insects like flycatchers, following them upon the wing, though this is sometimes done by all the *Sylvia* and *Salicariæ*. The writer of this has kept all the British species in confinement, and when tame, and suffered to fly loose about a room where there were plenty of flies, of which they are all extremely fond, he has often had occasion to observe, that, however quick they were at catching all that flew within their reach, they had not the slightest notion of following them into the air, as a willow-wren or redstart would have done. They invariably refuse earth-worms, and many sorts of caterpillars, but some they are extremely fond of ; this, however, depends much upon the species, the garden warbler devouring several which are rejected by the whitethroat, and *vice versâ*. In autumn they subsist more upon fruit, and various berries, of which they are very great devourers ; some of them, indeed, feeding on little else during their whole stay with us, ivy and privet berries, and the like, supplying the

place of garden fruit during the spring. They all frequently erect the feathers upon the crown of the head and throat, and whilst doing so, not unusually emit a sort of *check*, or *tchut*, which varies a little in the different species, and much resembles the sound produced by tapping two pebbles together. This note must be familiar to most persons residing in the country. It sometimes indicates suspicion, or fear, as it is uttered whenever they espy an enemy, but is also expressive of various other emotions. They are mostly shy and hidling in their habits, concealing themselves amidst the thickest foliage. Their colours are chaste and unobtrusive, and they would in general be very little noticed, were it not for the almost incessant warbling of the males. They chiefly nidificate in low bushes; the blackcap and the garden warbler, however, often build in a forked branch, at four or five feet from the ground, and the lesser whitethroat sometimes at the height of nine or ten feet, but all of them most commonly near the ground. The nest is of rather flimsy construction, but firmly put together, composed chiefly of the dry withered stems of catch-weed or goose-grass (*Galium aparine*), woven into a kind of basket-work; in some species always with a little green moss on the outside, and lined with fine dry grass and horse-hair, with the addition, in some species, of small fibrous roots.

There is not a more remarkable fact, nor one more indicative of the entire and absolute distinctness of our different small birds, than that every separate species invariably constructs its nest in a manner so peculiarly its own, that a practised eye would never mistake it for the nest of any other species; the materials, perhaps, may vary a little, according to the locality, though even this is seldom the case, and never in any very remarkable degree; yet the mode of construction is always so precisely similar in different individuals of the same species, that there is never much difficulty in identifying the nest of any one of them. Still, however, notwithstanding this distinctness, there is always a great generic similitude in the nests of different birds of the same natural genus, similar to that which obtains in the birds themselves; and the more the birds approximate, the more closely (as the term is) they are allied, so in the same ratio the more do their nests resemble; each, however, still preserving some peculiar distinctive characters by which it may be always known. Indeed, if we trace also the various intermediate links, which almost imperceptibly connect the most dissimilar forms together, we may almost always observe a regular gradation in the nests, similar and corresponding to that which prevails in the birds. The same gradation is likewise very often observable, even in the very notes and songs of birds, in the nature and disposition of their colours and markings, and in the colours and markings of their eggs. A practised ear will at once distinguish every separate species by its peculiar notes; as in the genus *Curruca*, the subject of the present article, those of all the different species of a natural genus may have a very strong generic similitude, yet each is always readily distinguishable from all the others. As we meet with no mule productions in a state of nature, no intermediate specimens, so we find no intermediate nests, nor hear intermediate notes; each preserves in every respect its specific characters. It will be conceded that the most remarkable generic resemblances are those of the nests; yet so truly does

this obtain, that, in many instances, both generic and specific divisions may almost as safely be deduced from an examination of these as from the study of the birds themselves. In the present instance we have not ventured to give a generic description of the nests of all the species of *Curruca*, although that of each separate species presents invariably certain marked peculiarities, by which it may always be at once distinguished from those of any of its congeners, however, on a superficial view, these may resemble it. A common species of *Curruca* in the south of England is

THE GARDEN WARBLER (*C. hortensis*), one of the most delightful songsters of this or any country, but which, notwithstanding, is most wonderfully little known to people in general. In size and form it very closely resembles the black-cap, indeed so much so, that an albino or white specimen of either could not very readily be distinguished. It is, however, somewhat shorter than that bird, and rather more thickly made; all over of an almost uniform olive-brown colour, rather paler about the throat, and inclining to white upon the belly, and usually having a dash of grey upon the sides of the neck. This is one of the latest of our summer migrants to arrive in spring, and also one of the first to depart, in this respect differing widely from the black-cap, which is always one of the first of the summer birds to make its appearance, and one of the very last to leave us; a difference, by the way, which is singularly enough observable in several migrant birds, that are nearly allied to each other. The garden warbler is never abundant in this country till the trees are in full leaf, but its presence is always soon announced by the delightful flow of soft and pleasing melody which it pours forth, often from the top of some tall pear-tree, or, if not in a garden, generally from amid the branches of an elm. Sometimes he commences with some low twittering notes, not much unlike the song of the swallow, and raising his voice by degrees, through a series of charming and most delightful flute-like modulations, he ends with the full rich whistle of the blackbird, but delivered in a more hurried cadence. He usually continues singing about three or four minutes, when he stops as if to take breath, and almost immediately commences again; deep, rich, and mellow, his lovely warble is heard nearly throughout the day, and occasionally even after sunset, singing nearly throughout the summer, and as the season advances often both beginning and ending with the same loud blackbird notes. As in all other birds, some individuals are much finer songsters than others.

The garden warbler does not appear to be quite so generally dispersed over the country as the blackcap, though it may be more so than is commonly supposed, as it is often confounded with that bird. It is certainly very abundant in many parts of the south of England, and particularly near the metropolis; and Mr. Selby states that it is found "throughout the greater part of Scotland, particularly where the wooded districts margin the lakes and rivers." Montagu traced it through the greater part of England. Both this species and the blackcap frequently commence singing a few seconds before they settle, as they fly from tree to tree, continuing their song uninterruptedly after they have alighted. Indeed, these two species resemble each other most closely in their general habits, and the history of the latter, as given in the article BLACKCAP, applies in almost every respect to that of the garden warbler. They are both great

devourers of fruit, which they prefer to insect food ; insomuch that, in confinement, when they first begin to get a little tame, they will frequently descend from their perch to eat fruit from the hand, when a buzzing fly has no attraction for them. In some of the species, as the white-throat and babillard, the reverse is the case, as, though extremely fond of fruit, these will sooner come down to a fly. The garden warbler is, perhaps, a greater devourer of caterpillars than any of the others, and in confinement will eat seven or eight in succession, of the caterpillars of the large white cabbage butterfly (*Pontia brassicæ*); which the others will not even touch. Its most favourite fruit seems to be the Kentish cherry.

Allied to this bird and the blackcap (*C. atricapilla*), there are several continental species, most of which have the outer tail feathers white. One of these, the *C. sarda*, chiefly inhabiting Italy and Spain, is said to be a charming songster. Another, the *C. melanocephala*, has very little melody to boast of. The *C. Ruppellii* is a beautiful species, the male of which has the head and throat black, divided by a white line ; this chiefly inhabits Barbary, and occurs, but only as a straggler, in the south of Europe. Further south we have the *C. Heinekia*, which, with the common *C. atricapilla*, is resident throughout the year in Madeira, and is said to be a fine songster. The *C. nisoria* is a European species, remarkable for its curiously spotted plumage ; and the *C. orphea*, an inhabitant of the south of France, is a very pleasing songster, resembling in its habits the common whitethroat ; this bird also has the crown of the head black, and is remarkable for generally nesting in society. The two last-mentioned species are of larger size than the rest.

An account of the babillard or lesser whitethroat (*C. garrula*) has been given in its alphabetical situation (see BABILLARD) ; closely allied to it are the *C. passerina* and *C. leucopigon*, both European birds. These three are of smaller size, and more restlessly active than the others. Their habits are intermediate between those of the blackcap and whitethroat. The last-mentioned bird (*C. cinerea*) is exceedingly common throughout the British islands, arriving in the southern counties about the middle of April, and frequenting hedgerows and commons that are covered with furze or brushwood. It is more a bush bird than any of the others, and frequently rises singing a little away into the air, a habit which is peculiar to it and perhaps the spectacle whitethroat (*C. conspicillata*), a smaller but very nearly allied Italian species. These too have the bill shaped somewhat differently from the typical or blackcap form, approaching more to a miniature of that of the blackbird ; in this, and in the habit of singing upon the wing, approaching to the Dartford warbler or furze wren, a species we shall presently describe, and which belongs to a separate subgenus. The whitethroat is an extremely lively and active little bird, almost perpetually singing, and ever erecting the feathers upon the throat and crown of the head, together with the tail, which gives it a characteristic appearance. The adult male has the irides yellow, the crown and region of the eyes dark grey ; the whole upper parts reddish brown, tinged with grey ; and the wing coverts and tertiaries broadly margined with mahogany. The throat is white, and the breast faintly tinged with rose colour, the latter hue being wanting in the female, which all over inclines more to reddish brown ; tail rather long, the exterior feather being a little shorter than the

rest, and having its outer web and tip white. All the birds of this genus may be readily known, as soon as hatched, from the other tribes of warblers, by their having the inside of the mouth and gape invariably red ; they leave the nest before they are half fledged, and skulk about the bushes, being only for a short time fed by the parents, who very soon commence again the work of nidification, and commonly rear three broods in a summer. The whitethroat, like the rest of the genus, frequents gardens and orchards in the fruit season, being a great devourer of cherries, currants, and the other smaller fruits. It appears to be a very long-lived bird ; for Mr. Sweet kept one in confinement for fifteen or sixteen years, at the end of which time it is described to be as active and lively as at first, to sing as merrily, and to show no sign of old age. They are very tame and familiar, and rather a hardy bird in confinement, and very amusing from their liveliness, singing with great spirit and energy against any other bird ; but, like the rest of the genus, they are very subject to a partial loss of feather during the winter. This species is exceedingly abundant upon open commons and furze-brakes, where its habits closely resemble those of the

FURZE WREN or DARTFORD WARBLER, as it is generally but not very appropriately called (*C. meligophilus provincialis*). This species was separated from the others by Dr. Leach ; it is of small size, with a bill like that of the whitethroat, but longer in proportion ; the tarsi also are rather longer than in the typical *Curruæ*, the tail is much elongated, and the wings are short and rounded ; in all which respects it approximates to the genus *Malurus*, an African group of warblers ; it does not, however, construct a domed nest like those birds, but in its nidification and eggs closely resembles the whitethroat and other curruæ.

This curious little bird was first discovered in England, near Dartford, in Kent, whence it has been usually denominated the Dartford warbler. It is rare however in that neighbourhood, although generally speaking, wherever it is found, it occurs in abundance. It is plentiful enough upon some of the commons in the southern counties, inhabiting only the very thickest furzes, where its habits are so very shy and hiding that a person might traverse for months various situations where it literally abounds, without being once aware of its presence. It has consequently been usually considered a very rare bird, though it certainly is an extremely local one. Perhaps it is no where more abundant than in the adjoining districts of Surrey and Sussex.

This bird is a little larger than the common wren, but much longer including the tail, its total length being about five inches and a half, of which the tail measures almost half. Its weight is about two drachms and a half. The eyelids are yellow, inclining to orange ; irides reddish yellow, whence in Sussex they are provincially called "Red-eyes." The bill almost black ; base of the upper mandible whitish. The whole upper parts dusky brown ; cheeks dark ash colour ; two outer tail feathers tipped, and the outer one also edged with white. The throat, neck, and breast, dark cochineal red, inclining to purplish red ; in the young of the year, the feathers of these parts have each a fine streak of white. Legs and toes yellowish brown. This bird, when flying, has a very dark appearance, seeming to be almost black. It differs from the other species in being resident in this

country throughout the year; and, perhaps, the best time to see it is upon a fine frosty morning, at which time it appears extremely active and lively; it is constantly in motion; erecting the crest and tail, and uttering a low note, resembling *cha, cha, cha*; it also sings prettily, sitting on the topmost branches of the furze, but the song wants variety, being always the very same over and over again. Sometimes it mounts singing a little way into the air, or suspends itself over the furze; but at the least alarm it will descend into the covert, and it will be a long time before you can get another sight of it. It trusts entirely to concealment for protection, threading the intricacies of the thickest bush with great rapidity; and if in a solitary detached bush, you may knock about for ever without bringing it out; it will sooner suffer itself to be taken by the hand. Both nest and eggs of this bird are very like those of the whitethroat, and the young quit the nest in the same manner, before they are half fledged: at this time the artifices of the parents to draw an intruder off are very amusing; they make the same harsh sound as the whitethroat, and will almost suffer the hand to touch them, and then, perhaps, will fall from the spray, and tumble along the ground, as if fluttering in the last struggle for existence.

In confinement its habits resemble those of the whitethroat and its congeners, and it feeds on the same food; this it will frequently take while suspended to the wires with its head downward. It will also sometimes climb along the wires, a habit which, among the British warblers, is peculiar to this species and the lesser whitethroat. Both these little birds, also, in the cage, frequently perform somersets in the air, throwing themselves over backward; and both of them, at times, will utter a singular sort of rattling note peculiar to themselves. The furze wren is found in some parts of Germany, and is very common in the south of France; from its abundance upon the commons in Provence, it has received the trivial name of *Provincialis*. Buffon was the first to describe it, which he did under the name of "*le Pitchou de Provence*."

CURSORIUS—Swift-foot, a genus belonging to the pressirostral division of *Echassiers*, or stilt-birds, of which the generic characters are as follow: bill slender, conical throughout, and with a moderate gape; wings very short, or of mean length, second quill the longest, the coverts as long as the quills; tarsi long and slender; toes three, all horned to the point, and without any web.

These birds form a sort of intermediate link between the ostriches and the plovers, they are birds of the deserts, shy and retired in their manners, and found only in the warm parts of the eastern continent; but one of the species, at least, is discursive over a great range of surface, and makes a dash into the southern parts of Europe, and even into England. They are, perhaps, the fleetest footed of birds; and, if they are not come upon by surprisc, or in places which are new to them, and in which they get bewildered and entangled among bushes, they are out of the reach of fire-arms in no brief space, so that very few of them are found. Of their time and manner of nesting, number of young, and other points of their economy in their native wilds, we are altogether ignorant. Three species, at least, are known.

CURSORIUS ISABELLICUS—common Swift-foot. A native of the northern parts of Africa: Isabelle yellow, or reddish cream colour, on the upper part, white on the under; top of the head red; two black rays over each

eye, separated by a patch of white; wing coverts bordered with ash colour, quills black; bill black; legs ash colour, length between nine and ten inches.—Sometimes, but very rarely, straggles into England.

CURSORIUS BICINCTUS—two collared Swift-foot. Also a native of Africa. Upper part brownish ash, each feather margined with reddish white; middle coverts of the wings reddish, quills black; rump white, under parts reddish; a narrow black collar on the lower part of the neck, and a broader one on the breast; rather larger than the former.

CURSORIUS ASIATICUS—Coromandel Swift-foot. A native of India. Brown on the upper part; top of the head, back of the neck, and breast, maroon red; lower belly and quills black; coverts of the wings ash-coloured, with white tips, and a black spot near the tip; thighs and coverts, and feathers of the tail, also white; bill black; feet yellow. This species is rather the smallest of the three; but there is no great difference in size between any of them. The last two have not been seen in the west of Europe.

CURTISIA (*Hortus Kewensis*). This is a tree from the Cape of Good Hope, named in honour of W. Curtis, founder of the Botanical Magazine, and other works relative to plants. It belongs to the natural order *Celastrineæ*, is treated as a greenhouse plant, but had never flowered in this country before 1831; according to the late Mr. Sweet, at the Cape it is called the Hassagay Tree.

CUSCUTA (Linnæus). This genus is one of the most curious vegetable parasites known. Two species are indigenous in Britain, and there are six or seven foreign species. It belongs to *Pentandria Digynia*, and to the natural order *Convolvulaceæ*. Generic character: calyx of four or five lobes. Corolla somewhat globular, persisting, four or five cleft, and having scales at the base: stamens growing to the tube of the corolla; capsule two-celled, opening at the base; cells two-seeded. The dodder, as it is called in England, rises from its seed like any other dicotyledonous plant, and is supported by its own roots until its stems can lay hold of some other plant. This it holds in a firm embrace, inserting small fibres or suckers into the bark of its supporter, whence it draws nourishment after its own roots are dead. The nurse often dies under the burthen and exhaustion caused by the parasite, which is not very nice in its choice of a foster parent; heath, furze, broom, or thistles are equally relished by the incumbent; and, if introduced into the greenhouse by accident, riots among the plants there as unceremoniously as if it were on its native common. The dodder is sometimes raised as a curiosity; seeds are sown in pots, and when the seedlings are strong enough, they are placed close to the side of some soft-wooded, worthless plant, which they soon lay hold of and cover, extending a considerable distance around, if not prevented. The plants flower abundantly, and some of the species are fragrant.

CUSTARD APPLE. (The fruit of a genus found in the East and West Indies, called *Anona* by Linnæus, because so named by the inhabitants of the Island of Banda, where some of the species are found. Indeed these fruit-trees are cultivated in gardens all over India, on the continent as well as on the Islands in the Indian Sea. In value and quality the fruit may be compared to some of our common pears, but with a less firm pulp, so soft, indeed, as to be easily sucked out of the skin. The *Anona cherimolia*, a native of South America, is said to be a fruit of very

great excellence, and by some preferred to all others. The sour and sweet sops of the West Indies are the muriated and squamose fruited custard apples; and are found useful even in that region of fine fruit. Some of the species have fruited in our stoves; and no doubt were their culture more attended to, by working the plants, and allowing space for their roots and branches, the fruit may be brought to a considerable degree of perfection. These plants require a rich loamy soil, and are propagated by ripe cuttings struck in sand.

CUTANEOUS SYSTEM, comprehends the skin and its appendages, hair, wool, bristles, spines, horn, hoofs, feathers, shells, crusts, scales, and other analogous structures.

The skin is composed of three layers of integuments, viz., the *Epidermis*, or cuticle; the *Rete mucosum*, or mucous web; and the *Cutis vera*, or true skin.

The epidermis, or cuticle, which is the external layer, is a dense semi-transparent, partially elastic membrane, which is common to all animal and vegetable bodies. It is everywhere continuous in its course, being reflected inwards into the mouth, nostrils, windpipe, gullet, and other open passages. By Dr. Munro, it was traced down as far as the cardiac region (upper portion) of the stomach of a horse, and by many physiologists it is supposed to line the whole tract of the alimentary canal. It invests the roots, stems, leaves, and flowers of all plants, forming an external covering, which protects them from the action of fluids, and from the extraneous effluvia which are constantly floating in the atmosphere. In thickness and texture, both in animals and vegetables, it varies exceedingly. It is very thin in birds, and along the mesial abdominal line of fish. In some animals, however, as the elephant and rhinoceros, it is so thick and impenetrable, that it constitutes an armour of defence which resists the assault of arrows, swords, javelins, and even musket-balls. It is thinnest in the human body around the lips, at the tip of the tongue, and at the extremities of the fingers; hence the sense of touch is most exquisite in these parts. It is thickest in the palms of the hand and in the soles of the feet, where, from repeated pressure, it is often converted into a dense horny substance. This thickness, however, is not altogether the result of pressure; for, even in the new-born infant, the cuticle in the palms of the hands and the soles of the feet is thicker than in any other part of the body. Its thickness, in like manner, varies in different plants. In the leaves of the pearly aloe it is very thin and delicate; around the trunk of the plane-tree very thick and coarse. Although insensible, this integument is still to be regarded as a part of the living system, for it is constantly undergoing decay and renovation. From the human body it continually exfoliates in small scales, and in some persons in very large patches, especially after sickness, on account of the vessels, which may be regarded as the connecting link between it and the subjacent layer, having become debilitated. At certain seasons of the year some animals, as serpents and caterpillars, cast their skin in an entire sheath. It is the same with plants. From the birch and currant tree the cuticle peels off constantly in small scales; from the elm it is detached in large flakes. The connexion between the cuticle and the subjacent layer of skin is very close; it is, however, readily

separated by blisters and by heat. Alcohol also loosens it in many of the inferior animals, as may be observed by immersing worms in this liquid. When the cuticle of the blistered surface has been thus destroyed, it is very speedily renewed—more speedily, indeed, than any other tissue of the body.

The skin, being the outer covering of the body, and affording it a surface of protection, does not readily absorb extraneous matters; yet, when the epidermis or cuticle is removed, and the subjacent layer laid bare, then absorption takes place very rapidly; hence, in order that the operation of inoculation or vaccination shall take effect, the virus must be introduced below the cuticle. This has been a subject of some contention; for, although the cuticle does obviously permit the transudation of sensible perspiration, the pores through which it passes are certainly not perceptible. The fact of cuticular absorption (says Dr. Milligan, after reviewing the experiments of many philosophers) may be thus stated:—The cuticle has no absorbing orifices opening on its surface, and the substances supposed to be taken up by these really make their way into the body by the action of the absorbing vessels of the lungs and subjacent cutis vera; yet, from the imbibing faculty common to the cuticle with dead or unorganised matter, many substances may, by long maceration or external violence, find a passage through it without any laceration being visible. It may be proper, however, to observe, that pores running in a spiral direction have been discovered in the cuticle of the whale; and, arguing from analogy, it may perhaps be inferred that similar spiral pores exist in the human cuticle, although so minute as to escape demonstration. The eminent Amici has, by the aid of his powerful microscope, shown that oval orifices, or *stomata*, as they are called, exist in the cuticle of plants, especially of those which have a green colour. No such stomata have, however, been detected in aquatic plants; their use, it is presumed, is to exhale water and absorb air. There are many provisions in animals to preserve the cuticle in a healthy state, which consist principally in secretions of an oily or viscid nature. In fish and mollusca it is defended from the action of the water by a viscid or glutinous secretion, which is continually poured out on the surface. This secretion keeps the skin of whales soft and smooth, like oiled silk, and enables them and other aquatic animals to emerge from the water with the cuticle dry. It is in some cases glairy and adhesive, as in the common slug; or mucous and slippery, as in the common eel. The cuticle of animals is, in the living body, readily distended, as may be observed by its extension in tumours, or swellings of subjacent parts. It is, however, less elastic in plants. When overtight, it causes contraction of the stem, as may be often seen in the plum or cherry-tree; and when subjected to pressure from unnatural excrescences, it is frequently ruptured; so also, when the trunk of a tree, as the oak or the elm, has attained a certain size, the surrounding cuticle cracks, and the surface of the trunk becomes rugous.

Immediately below the cuticle, and intermediate between it and the cutis vera, is the second layer of the skin, which was supposed by Malpighi to be formed of a peculiar mucus, wherefore it was called the *RETE*, or *CORPUS MUCOSUM*. Other authors regard it as a vascular net-work; and M. Gall supposed that it consists of matter similar to the brown matter which

exists in the brain. It may be described as a thin extended pulpy layer. It is the seat of colour, being white in the European, copper-coloured in the American, and black in the negro. Haller, Camper, and Blumenbach, doubted its existence in very fair persons. It is certainly not seen distinctly excepting in the negro.

The different complexion or colour of mankind, in different regions of the globe, has, it is notorious, given rise to various opinions and speculations; by some, being referred to a difference in original organisation; by others, being ascribed to the influence of climate, food, and other secondary causes. That this rete mucosum is, however, really the seat of colour, there appears to be no doubt; and the following ingenious theory in explanation has been proposed by Blumenbach:—The human body, it is well known, throws off a vast quantity of carbonic acid; that is, carbon in combination with oxygen gas. He supposes, then, that this carbonic acid is in this mucous layer decomposed, the oxygen is set free, and the carbon or colouring matter deposited on the mucus, which combines with it. This decomposition is presumed to be determined by the intense light and heat of a tropical climate; those parts of the body, therefore, which are protected from the light and heat of the sun, are not so dark as those which are more exposed. The palms of the hand, and the soles of the feet, are not in the negro so black as the face, neck, and back of the hand. African ladies, who live in the shade, have a much paler complexion than those who are much occupied in the open fields. It is darker in some parts of the body than in others, as in the eyelids and arm-pits. According to Cuvier, the shell of molluscous animals, the crust of the lobster, and other crustacea, occupy the place of this layer. It also degenerates into the thick dense horny substance, which form the beaks and claws of birds, and the claws of other animals. Under the cuticle of plants, the corpus mucosum is also found, and is described as the cellular integument (*envelope cellulaire*).

It is very obvious, in mosses and ferns, and is in plants also the seat of colour, being green in young stems, and white in those which are colourless. Mirbel remarks, that leaves consist almost entirely of this substance, covered on each side with cuticle. The stems and branches of both annual and perennial plants are invested with it; but in woody parts it is dried up and re-produced continually, such parts only having that reproductive power. The old layers remain, are pushed outwards by the new ones, and form at length the rugged dry dead covering of the old trunks of trees. In the *Quercus suber*, a species of oak abounding in dry mountainous districts in the south of France, and in Spain, Portugal, Italy, and Barbary, this herbaceous envelope is remarkably thick, light, and porous, and constitutes what is well known as the cork of commerce, a substance which was well known to the Greeks and Romans, who used it as stoppers for vessels (Pliny, Hist. Nat., lib. xvi. cap. 8.), although it was not extensively applied to this purpose until glass-bottles were introduced, which was generally done in the fifteenth century. In this part of the plant the principal changes of the sap take place, and an operation is effected which is of vast importance in the economy of nature. Already it has been stated, that the human body throws off continually a certain quantity of carbonic acid gas;

by the respiration alone about a pound of carbon is got rid of daily; mammalia, and inferior animals, likewise expire it; as do also plants when in the shade. This being a very noxious, indeed poisonous gas, it may reasonably be asked, how the atmosphere is purified from it, and the earth rendered fit for the abode of living beings? Herein the wisdom of creative Providence is beautifully illustrated. Carbonic acid is composed, it has been said, of carbon and oxygen; the carbon is the basis of vegetable bodies, the characteristic ingredient of all kinds of charcoal. When the sun shines upon a plant, its leaves absorb the carbonic acid from the atmosphere, and decompose it; and this takes place in the herbaceous envelope; here the oxygen is set free, and the carbon left to be appropriated to the basis of the plant. The vegetable creation, therefore, is constantly purifying the atmosphere, yielding for every volume of carbonic acid which it absorbs an equal volume of pure oxygen. Upon this principle, some have supposed that, in the beginning of the world, plants were created before animals, and gradually purified the atmosphere, so as to render it fit for their abode. Be this as it may, the provision is exceedingly interesting, and calculated to excite the admiration of every reflecting mind.

Underneath this mucous layer, or rete mucosum, is the cutis vera, or true skin, which exists in all animals; but is less distinct in mollusca and crustacea. In quadrupeds it appears to consist of solid fibres, which cross each other in every direction; in fish it seems an homogenous and continuous membrane. Over this integument, an infinite number of blood vessels, and the extremities of nerves are distributed; so that it is properly speaking, the seat of the sense of touch. It is provided also with a vast number of little eminences or papillæ, which were discovered by Malpighi in the foot of a pig, in each of which the extremity of a nerve is supposed to terminate. These papillæ are particularly conspicuous in the parts most appropriated to the sense of touch; as the tips of the fingers, the point of the tongue, and the lips. They are also well seen in the bills of aquatic birds, as the swan, goose, and duck, and doubtless enable these birds to find the food concealed in the mud. They are also larger upon the lips of fish; on the toes of birds which, like those of the parrot kind, use their feet as organs of prehension; and round the lips of the shrew, the mole, and animals that burrow under ground. The vessels of this true skin throw off the watery part of the blood in the form of insensible and sensible perspiration; the former escapes imperceptibly, the latter perceptibly. By some it is considered doubtful whether the vessels of insensible are the same as those of sensible perspiration; the fact that the dog perspires insensibly, but does not perceptibly, favours the idea of the two kinds of perspiration being dependent on a different set of vessels. The cutaneous perspiration serves several important purposes in the animal economy; it keeps the outer skin or cuticle moist and supple; it favours the exercise of taste and touch; and regulates by its evaporation the temperature of the body. The cutis vera is also supplied with a number of little organs called follicles, which secrete an unctuous and sometimes sebaceous matter, varying in consistence, odour, and other qualities in different animals, and which, as already premised, preserve the skin in a healthy state. The vessels also of the true skin secrete carbonic acid, which is discharged from the surface of

the body : so that, besides being the organ of touch, the function of the skin is vicarious with that of the lungs, serving to remove the superfluous carbon from the system. It serves the same purpose even with fish ; for Spallanzani and Provençal found that the skins of fish produced carbonic acid as well as their gills. Although in plants an epidermis or cuticle, and envelope analogous to the rete mucosum, is found to exist, they do not appear to possess any integument analogous to the cutis vera, which, in descending the scale of organisation, may be said to terminate with the crustacea. The skin then of animals is found to consist of these three layers, which, when chemically examined, are discovered to be composed almost entirely of gelatine, an animal principle which united with tannin, forms the remarkable substance leather. When the skins, therefore, of animals are macerated in bark, the tannin of the bark, uniting chemically with the gelatine of the skins, forms this compound, which is insoluble in water, resists putrefaction, and becomes hard and tough when dry.

The cutaneous system of animals and vegetables comprehends also, as already mentioned, the appendages to the skin ; such as hair, wool, horn, feathers, shells, &c. HAIR is common to all mammalia, whales not excepted ; it also occurs, mixed with feathers, round the head and neck of certain birds ; it is, however, absent in reptiles, fish, and mollusca, although found to exist in many annulose animals, and even zoophytes. Every individual hair may be described as consisting of a hollow tube proceeding from a root or bulb below the cuticle, and terminating in a very fine point. The bulb is of an ovoidal shape, and consists of an external and internal covering—the former being composed of condensed cellular tissue ; the latter being a simple membrane which lines the interior of the tube. The cuticle introduces itself into the bulb, and having become attached to the hair at its root, is reflected back again ; hence the hair holds firmly to the skin. The tube arising from the bulb is filled with a soft matter called the medulla or pith of the hair, which is the seat of a kind of imbibition whereby the colouring matter secreted by the vessels of the bulb is raised so as to give an uniform colour to each individual hair. The human hair is generally either black, brown, auburn, yellow, or red ; besides which a white variety characterises the race of people termed Albinos. When the vessels which secrete this colouring matter, and which also nourish the hair, become debilitated—or when the secretion is interrupted by any violent mental emotion, the hair turns grey, or becomes purely white. This happened, it is well known, to the unfortunate Louis XVI. of France, the night previous to his execution ;—also to Marie Antoinette, the queen of France, whose hair became white during the period of her journey from Varennes to Paris. It also occurred to the unhappy queen Mary ; and many other cases of a similar description are on record. Sometimes even after the hair has turned grey during a period of affliction, it will afterwards recover its natural colour—and this loss and recovery of colour has occurred to some persons in a very short space of time. Black hair has been generally considered significant of a vigorous constitution ; white, on the contrary, was called by Lord Bacon the “colour of defect,” and is regarded as a sign of debility. Hence, horses with white feet, are thought to be more tender and susceptible of disease than those of a more uniform dark colour. When the ves-

sels which nourish the roots of the hair become debilitated, as in extreme old age or after sickness, the bulb collapses, its attachment to the skin is destroyed, and the hair is shed. This sometimes occurs irregularly and in patches : sometimes the disease is universal, and not a hair remains on the surface of the body. This occurred to the chevalier D'Eperney, who, after four months' studious application, and without any illness, lost his beard, eyebrows, eyelashes, and all the hair of his head and body. Certain kinds of diet, especially a fish diet, is said to produce baldness. In the Shetland islands, so common was baldness formerly, that it was a common saying that “there was not a hair between them and heaven.” Tournefort relates, that in the island of Mycene the inhabitants seldom arrive at the age of twenty-one without becoming so. There are some races of people that have little or no hair on the surface of the body. The Mongolian, Chinese, and American have little or none upon the chin or chest. Hair varies considerably in shape, texture, and in all its mechanical properties. Instead of being cylindrical, it is sometimes flattened, striated, and deeply grooved, or even beaded. It also varies much in length, firmness, tenacity, and disposition to curl ; all which varieties depend on some corresponding difference in the relative action of the vessels at the bulb or root. The human hair which is most esteemed in commerce, is about twenty-five inches in length ; and the more it falls short of this, the less value it bears. Its length and quantity is, in all animals, much influenced by change of season and climate. Previous to winter, the hair increases in length and quantity, and this increase bears a ratio with the temperature ; hence cattle and horses in farms near the level of the sea, have a shorter and thinner hair than those in higher elevations, where the temperature of the air is lower. The fur of animals, which is sought as an article of commerce, is thin, and would be less valuable if obtained during the summer than during the winter season. The influence of climate is still more obvious. The dogs of Guinea, and African and Indian sheep, possess so little hair on the body, that they may be almost said to be naked ;—the Siberian dog and Iceland sheep are, however, protected by a very long and thick covering. The fleece of sheep in England is entirely wool ; the Zetland and Iceland sheep, however, in addition to wool, have intermixed with it a quantity of coarse and shaggy hair. In warm countries the elephant and rhinoceros have scarce any hair ; on the contrary, the carcasses of those discovered in the ice of Siberia, are found covered with a sort of wool mixed with long thick hair, very similar to the coat of the Iceland sheep. To accommodate themselves to this change of season and climate, animals cast and renew their hair, just as birds moult, or as serpents and caterpillars cast their skin. Moles cast their winter clothing generally before the end of June. The fleece of sheep, if allowed to fall, is generally cast before the end of July.

In some cases the nerves which supply the roots of the hair serve to extend the sense of touch ; thus the hairs which form the whiskers of the lion, tiger, and cat, being supplied with pretty large nerves at their roots, the slightest impression is communicated from their joint to their base. It is the same with the whiskers of the seal. The hairs of the whiskers are moved freely at the will or pleasure of these animals, which is not the case with the hairs of the rest of the body, although under certain vio-

lent emotions, fear, fright, or anger, they are observed to become erect. This is caused by a muscular web, which lies below the skin, and is called the *panniculus carnosus*, the fibres of which in contracting force the hair into an erect position. It is well seen in dogs and cats. It commands, also, the erection of the quills of the porcupine, and the spines of the hedgehog. The colour of the hair of many quadrupeds, like the plumage of birds, changes at certain seasons of the year. The summer dress of the Alpine hare (*Lepus variabilis*) is of a tawny grey colour; as winter approaches, it gradually changes until it becomes snow white. The ermine, which frequents the outskirts of woods and thickets during summer, is of a pale reddish brown colour; in August it becomes clouded with pale yellow, and in November it is snow white. As spring returns the white becomes mottled with brown spots, and in the month of May its summer garb is resumed. The hair even of the human body is somewhat lighter in winter than in summer.

Wool is a cutaneous appendage which differs in no respect chemically from hair; it is, indeed, generally described as hair short and crisped. It differs, however, from hair, in being finer in texture and in growing more uniformly. Each filament of wool grows at equal distances, and if not shorn, all the filaments separate nearly at the same time from the skin, for the wool completes its growth in twelve months, and is then shed. Another peculiarity is the different degree of thickness which prevails in the wool on various parts of the same animal, besides the filaments are closer at their extremities or points than at their roots. Furthermore, the fleece which grows during winter is of much finer quality than that which is produced during summer. The physical qualities, however, of wool, are considerably affected by the soil on which sheep feed. It has been shown by Mr. Bakewell that the herbage of each district derives from the difference of soil peculiar properties, which when taken as food, have the power of affecting that process of the animal economy by which wool is produced. Accordingly, the wool of sheep pastured on chalk districts, or light calcareous soils, is hard and harsh to the touch; the wool of those pastured on rich loamy argillaceous soils, is always distinguished by its softness. The soils most favourable to the soft quality are, first, the argillaceous, and next, the siliceous; the calcareous, whether limestone or chalk, produces wools of a contrary quality; so that in proportion as these earths preponderate in a loose state near the surface of different soils, their effect may be detected, whatever be the breed of sheep from which the wool is shorn. If the weather be fine, sheep in this country are shorn in the month of June, although some farmers delay the operation until July. The wool in the state first shorn is called fleece, and each fleece is usually separated into three sorts: 1, mother wool, or that of the back and neck; 2, the wool of the tails and legs; 3, that of the breast and under the belly. This classification corresponds with the Spanish method of sorting into *rafinos*, or prime; *finos*, or second best, and *terceras*, or inferior sort. Till within a few years, the finest wool was imported from Spain; but next to Spanish sheep, the English yield the finest wool that can be introduced into the market.

BRISTLES and SPINES are modifications of hair; in the former the hair is stiff, in the latter inflexible. The bristles growing upon the back of the hog and wild boar form a considerable article of commerce,

being extensively used by brushmakers, shoemakers, saddlers, &c. They are imported into this country from Russia; those of Ukraine being held in the highest estimation.

HORN is a substance analogous to hair, and has, indeed, been identified with it. When the horn of an ox is examined, it is found to consist of fibres which run parallel with each other from the root to the point of the horn, sweeping along the course of whatever curvature it may describe. Their disposition, however, varies. Instead of being straight and sweeping, these fibres in the horn of the ram present a waved or undulated appearance. Hence the substance of horn appears to be made up of a conglomeration of hairs; but this is not always the case, for the horns of the camelopard and stag are truly osseous. It would appear, indeed, that horn differs from bone in this, that horn is composed principally of animal matter intermixed with very little phosphate of lime or other earthy matter, while bone consists principally of phosphate of lime with very little animal matter. The density and compactness, therefore, of the horn, depends on the quantity of earth or animal matter entering into its composition. The horn of the rhinoceros is purely a cartilaginous or horny substance; here the animal matter predominates; the horn of deer is purely osseous, in this case the earthy matter predominates. Horns are in most animals to be regarded as weapons of attack and defence; and as such they are instinctively used; hence young cattle are observed butting with their head months before their horns appear.

The manner in which the horn is developed is as follows: immediately below the skin, and over the frontal bone, two tubercles may be seen in the young calf. These gradually become more callous, and enlarge in size, shooting out conically. This growing horn consists of three parts, an external sheath or prolongation of the cuticle, a vascular investment, and an internal osseous substance. The vascular membrane has two different powers of production at each surface; the internal supplies the phosphate of lime; the external deposits layers of horny substance. When three years old, the horn is smooth and handsome; afterwards its annual growth is marked by a circle or wrinkle at the base; and, according to the number of these, the age of the animal may be determined. Horns, however, do not always grow from the frontal bone; in the rhinoceros they proceed from the nasal bone, and in many other animals they arise immediately over the ridge of the occipital bone. In some species, as the stag, the male only has horns; and, generally speaking, as in the case of the goat, where both male and female have horns, the female are smaller than those of the male. The horns, however, of the bull are shorter and denser than those of the cow. Between the size of the horn and bulk of the animal there is no correspondence; some small breeds of cattle have very large horns, while some good-sized cattle, as the Yorkshire-polled cattle, have no horns at all. Horns vary remarkably in shape and size. The horns of the goat are rough, angular, and bent retrally; those of the red deer are branched, round, and recurved. The roe possesses horns which are round and erect; the fallow deer horns palmated at the top. The length of the horn varies considerably. Cattle with long horns are said to excel in their hide, hair, and the *quality* of beef; those with short horns in the *quantity* of the beef, tallow, and

milk they yield. The antlers of the stag, after remaining nearly a year, are cast off and soon replaced. Immediately before this occurs the carotid artery is seen to throb, and all the vessels of the skin are turgid, the heat of the parts being much augmented. A tubercle is then observed below the skin, which gradually increases in size, as it becomes converted into bone. The cartilage being ossified, shoots upward in the form of a lengthened cylinder, which soon divides into branches. The skin being carried along with and investing the horn, forms what is called its *velvet coat*, but when fully formed, it shrivels and peels off, and the antler presents then a smooth and bare surface. The rapidity with which the vessels form the antler is remarkable; an antler weighing thirty pounds is sometimes completely formed in the space of fourteen days. After being fully developed, the vessels at the base continue to deposit additional osseous matter, which is called the *burr*. The accumulation of this substance at length encroaches on the arteries, and by diminishing their capacity for containing blood, gradually cuts off the supply of nourishment. The antler is then nourished only by its own internal vessels. These at length shrink and become obliterated, and the horn then adheres to the head only as a foreign body. In the mean time the absorbent vessels under the base of the horn, scoop a groove between the living and the dead matter, so that the antler, deprived of support, falls upon the slightest concussion. Thus are these graceful appendages to the figure of this animal annually cast and reproduced.

BEAKS, NAILS, CLAWS, SPURS and HOOFS, are of the same composition as horn, consisting principally of gelatine with only a trace of earthy matter. The horny substance of the beak differs from horn in its colour not being so fixed. The colour of the bills of many birds varies with the season, and changes also after death: the colour of the horns of cattle is permanent. Nails differ from horn only in not being tubular, but deposited in flat plates. They occur in the toes of quadrupeds, birds, reptiles, and pass into claws. Spurs occur chiefly in gallinaceous birds; they are softened by heat, and may be easily bent into particular shapes. Hoofs are peculiar to herbivorous animals, forming a solid base and protection to the foot.

FEATHERS, which are the characteristic appendages to the cutaneous system of birds, form a covering which not only protects them from the inclemencies of the weather, but which, when large, as in the wings and tail, serve as instruments of motion. The structure of a feather is exceedingly curious. Each feather consists of a tube or barrel, from which proceeds the shaft or stock, on each side of which are affixed barbs or flat filaments tapering to a point. The tube or barrel takes its rise like hair in the tissue immediately below the *cutis vera*, and passes by a tubular opening through the other layers of the skin, which are so folded downwards and inwards as to form a sheath, which invests the bulb or vascular part of the feather. The tube or barrel is a hollow, horny, transparent cylinder, consisting of two layers, an external and an internal. The external is a circular plate, exhibiting linear impressions which run round the barrel in a transverse direction; the internal consists of fibres running longitudinally. It is largest in anserine and gallinaceous birds, as the turkey, swan, goose, &c., for which reason the quills of these birds are best

adapted for making pens. By being formed into a hollow cylinder, the barrel of the feather is rendered stronger, lighter, and more capable of resisting flexion, than it otherwise would be. Its cavity indeed in some birds of flight, as the condor, eagle, and hawk, is continued some way into the shaft, and is, like the bones of the skeleton, filled with air, which enters into it during respiration through a minute orifice at the extreme point or end of the quill. Within the barrel is a dry jointed membranous substance, which is the remains of the vascular pulp which originally contributed to the growth and nourishment of the feather. The shaft which is prolonged from the barrel consists of a cuticular layer, disposed likewise in a circular and longitudinal direction, the central portion of which is filled with a pithy substance like cork. Its outer surface is slightly convex, its inner nearly flat, with a groove running along the middle. From each side of the shaft proceed the barbs, which are placed with their flat sides towards each other, whereby a power of resistance is derived which enables them when flying to encounter the impulse and pressure of the atmosphere.

They derive this power of resistance, says Dr. Roget, from the flattened shape of these filaments, which allows them to bend less easily in the direction of their flat surfaces than in any other, in the same way that a slip of card cannot easily be bent by a force acting in its own plane, though it easily yields to one at right angles to it. Now it is exactly in the direction in which they do not bend that the filaments of the feather have to encounter the greater resistance and impulse of the air; it is here that strength is wanted, and it is here that strength has been bestowed. But this is not all: in birds of flight and water birds, the barbs are, by their adhesion to each other, rendered firm, and this is effected by a very curious mechanism. When viewed under the microscope, a number of minute fibrils or processes are seen arranged along the margin of the laminae, so curved as to interlace with or clasp one another whenever they are brought within a certain distance. Those fibrils which proceed along the side of the laminae in the direction from the quill and to the extremity of the feather are long, flexible, and bent downwards; those which proceed from the adjacent lamina, from the extremity of the feather towards the quill end, are shorter, firmer, and turn upwards, so that when the long fibrils are forced far enough over the short ones, their crooked parts fall into the cavity made by the crooked parts of the other, just as the latch that is fastened to a door enters into the cavity of the catch fixed to the door-post, and there hooking itself fastens the door. These little teeth, like processes or barbules, are wanting in feathers not intended for flight; hence they are not found in the feathers of the ostrich, nor do they interclasp each other in the manner above described in the feathers of the peacock's tail, nor in those placed around the ear of the owl. The feathers of nocturnal birds of prey have the barbs covered with long silky down, whence, it has been observed, arises the slow and silent flight of these birds.

The mode in which feathers grow or become developed has been attentively examined by several naturalists, especially by M. Cuvier, whose memoir in the *Mémoires du Muséum*, tom. xiii., comprehends almost all that is known on this intricate subject. On quitting the egg, the body of every bird is found covered, excepting the under part of the belly, with a sort

of down consisting of minute filaments collected in tufts, which are implanted in a bulb or follicle which contains the sheath of the feather. When the sheath protrudes through the skin it has the appearance of a thorn or little cone, within which may be observed the medulla or that central gelatinous cord which may be considered to form the different parts of the feather. Upon its protrusion the tufts just described generally fall off, excepting in the eagle, vulture, and other rapacious birds, to the feathers of which it remains attached for a considerable time resembling fine down. From the medulla or pith the barbs are first discovered proceeding from it in very delicate and thin filaments; then the shaft or stalk of the feather makes its appearance, to which they soon become attached; the whole being enclosed within the sheath, the barrel end of which is filled with a glairy fluid. In proportion as this fluid becomes converted into the barbs and shaft, the central cord withers and corrugates. The sheath is at length burst open, and the medulla appears encircled by the barbs and shaft. These parts being formed, the remaining part of the medulla becomes enveloped with the matter of the quill which is a continuation from the shaft. The quill therefore is the last part formed, and continues to increase in length for some time after the full growth of the barbs and shaft. When feathers have reached their full growth they become dry, and only the tuber or medulla within it continues to absorb moisture at its termination or bulb. It gradually, however, ceases to receive this nourishment; its attachment to the skin then becomes loosened; and the feather is cast, and again in the manner described renewed. This periodical change of plumage is termed moulting, during which period birds generally become sickly and much debilitated. Immediately below the feathers of aquatic birds, in the region especially of the chest, other small and very delicate feathers are found which are called down, which serves to protect the body from the action of the water, and which, not being good conductors of heat, likewise preserve the temperature of the body. The down of the eider duck is esteemed the most valuable. These birds pluck it from their breasts to line their nests with it. So elastic is it that a quantity weighing only three quarters of an ounce will spread over a larger surface than the crown of the greatest hat. That found in the nest, which is termed live down, is much more elastic than that plucked from the dead bird, and is more highly esteemed.

The colour of the plumage of birds varies exceedingly, being in many species, especially in tropical climates, of dazzling brilliancy. The iridescence of the plumage is referable to the same cause as the colours of very thin plates, which has been explained in the article COLOUR. It is, however, remarkable that the colour of the plumage of certain birds undergoes a change at different seasons of the year. Among aquatic birds, the black guillemot (*Uria Grylle*) is of a sooty black in summer, with a patch of white on each wing; as winter approaches, the black gradually disappears, until the plumage becomes white, mottled with ash-coloured spots. Again, the ptarmigan or mountain grouse (*Tetrao lagopus*) has an ash coloured plumage, which, however, changes in winter to a snow-white; a providential change, says Montagu, for, were the surface of the ground not consonant with their colour, few would escape the

searching eye of the falcon or the eagle in the lofty and exposed situations they are found to inhabit. It has therefore been wisely ordained that the young first appear, like their parents, in a mottled plumage, similar to the lichen-covered rocks they frequent, and continue in this dress till the approach of winter, when old and young become equally white as the surrounding snow. In the Scottish Highlands this change commences about the month of September; large patches of white appear on the feathers of the wings and back; these extend, and in the month of January the bird is of a pure white. The return of colour commences by the appearance of black spots, which enlarge; they become of a brownish hue, until the colour and the summer plumage is completely resumed. This change of colour is, however, sometimes limited to a certain part of the body. Thus the cheeks and throat of the little auk (*Alca alle*) are black in summer, and become of a dirty white in winter; the head of the black-headed gull (*Larus ridibundus*), as the name indicates, is black in winter, and becomes white in summer.

SHELLS and CRUSTS are a part of the cutaneous system of the crustacea, besides which they occur to several of the annelides, as the serpula and dentalium. They consist simply of layers of earthy matter interposed between membranes of animal matter. This deposition takes place between the epidermis or cuticle and the cutis vera or true skin. It occupies the place of the rete mucosum above described. Crusts differ from shells only in being more brittle, in consequence of being composed of a greater quantity of earthy matter. In shells the carbonate of lime predominates; in crusts there is also a considerable portion of phosphate of lime. The size, texture, shape, and colour of shells, display an infinite variety. The shield of the snail is semi-transparent and elastic, the shell of the volutes opaque and hard as marble. River shells are not so diversified in form and colour as land and sea shells; but so numerous and varied are the characters of shells, that their study and classification constitutes, under the term CONCHOLOGY, a complete department of natural history.

The crusts of the crustacea like the hair of quadrupeds, or feathers of birds, are cast periodically, and when injured or destroyed are easily renewed. When this change occurs in the lobster, his shell grows soft, the sutures open, and the claws burst at the joints. Thus loosened, the animal, by a trembling motion, or sort of spasm casts off his case, and then retires in a state of nakedness to the hollow of rocks. The released body then makes a sudden growth, and in about eight and forty hours a fresh concretion of humour is deposited over the whole surface of the body, which soon hardens into a crust, which is adapted in every part to the increased size of the animal. This change takes place annually. Besides in the crustacea, properly so called, crusts occur in certain insects, echinodermata or sea urchins, and starfish.

Lastly. SCALES are the cutaneous appendages or covering proper to fish; they are found also in every part of the body of certain reptiles, and also upon the feet of birds. They are composed of the same matter as the cuticle which extends over them; and they vary considerably in size, form, colour, and relative position. Such are the appendages, which constitute a part of the cutaneous system of the different classes of animals which inhabit the earth, the air, and the waters; and which afford a protection adapted in the

best possible manner to their different and individual exigencies.

CYAMUS (Latreille). A genus of crustaceous animals belonging to the section *Edriophthalma* and order *Læmodipoda*, and having for its type a curious species, which is found upon the bodies of living whales, being the *Oniscus ceti* of Linnæus. This genus constitutes a distinct division in the order to which it belongs, to which Latreille has given the name of *Ovalia*, oval bodied, in order to distinguish it from the other division of which **CAPRELLA** (which see) is the type, and which is remarkable for the long and slender form of the body. These animals were considered by M. Savigny as being nearly allied to the *Pycnogonida*, and forming with them the passage between the crustacea and arachnida. The body is composed of a small somewhat oval-formed head and six transverse segments, the abdomen being very minute and rudimental. The head is furnished with two moderate sized and two minute antennæ, with an oral apparatus, concerning the various organs of which authors are somewhat at variance. At the base of each of the smaller antennæ is a small depressed cup-like spot covered with a membranous substance, and which has been regarded as the organ of the sense of hearing. The eyes are two in number and granulated, although Savigny calls them "yeux lissées," whilst the yeux composées, which he mentions between the antennæ, are not discernible. The legs, or the limbs representing those organs, are of varied form, the first pair being slender and terminated by a claw and a moveable finger, the second, fifth, sixth, and seventh pairs are greatly dilated and terminated by a large joint, and a moveable recurved finger; but the most curious portions of the animal are the organs representing the third and fourth pairs of legs, and which consist in two or four pairs of long and slender appendages, which have been considered to be organs of respiration; these are, moreover, furnished on the underside of the body of the females with four large plates serving as a pouch for the reception of the eggs.

We are indebted to M. Roussel de Vanzème (whose memoir upon another whale parasite, *Cetochilus australis*, we have in an article upon that genus noticed,) for the most complete account hitherto published of this curious group of parasites, and which were observed by him in his voyage to the whale fisheries in the Southern Ocean. Previous to the publication of his memoir in the *Annales des Sciences Naturelles* for May 1834, one species only had been described, although Latreille in the *Règne Animal* had mentioned the existence of two other species inhabiting the Indian seas and the ocean near the Cape of Good Hope. M. Roussel, however, not only distinctly described three species living upon the whales of the Southern Ocean, but also observed their respective habits.

Sometimes these creatures are so abundant upon the whales, that the infested animals can be easily recognised at a very considerable distance by the white colour which they impart to the whale, and which is visible when it rises to the surface. When these parasites are removed the surface of the body is found to be deprived of the epidermis, and as it were corroded. They are ovoviviparous, producing eggs which are received into and hatched within the pouch-like plates on the undersides of the centre of the body, at times eggs alone, at others both eggs and young, and at others young only being observable in

the pouch. *Cyamus ovalis* and *gracilis* are stationary, being found in great numbers agglomerated upon the corneous eminences of the *Balæna mysticetus*. *C. erraticus* is, however, organised for its wandering habits, being of a slender form and with stronger legs serving for prehension. The young ones appear with all the characters of their kind, only the head is rather large, and the supposed branchial appendages instead of being long and slender are short and somewhat globose; the females of *C. ovalis* cover their young with their bodies, whilst those of *C. erraticus* abandon their young conformably to their own mode of life; and in *C. gracilis* the females, males, and young are all found mingled together.

CYANELLA (Linnæus). A bulbous genus from the Cape of Good Hope. Linnæan class and order: *Hexandria Monogynia*, and natural order *Asphodeleæ*. Generic character: corolla of six-spreading unequal petals, inner ones longest: stamens below the germen; filaments united on a fleshy eup at the base; anthers erect, five are equal, bursting at vertical pores; the sixth twice the size, and oblong. Style declining; capsule three-celled, three-valved, and many seeded. The flowers of this genus are of various colours, handsome and sweet-scented. The plants are kept in a pit or frame, or may be planted in front of a hothouse, where they will succeed if defended from frost.

CYANITE, a mineral which derives its name from a Greek word, indicative of its sky-blue colour. When pure, it is idio-electric, as some crystals by rubbing acquire negative electricity,—and others with a similar surface positive electricity: hence the name *disthene*, given by Haüy to this mineral on account of its double electrical powers. It occurs massive, and disseminated; and is sometimes regularly crystallised. The primitive figure is an oblique, four-sided prism. It is found in various parts of Europe, Asia, and America. The Shetland Islands produce some very beautiful specimens, and it is readily distinguished from actynolite by its cleavage and infusibility.

CYANUS. Is the *Centaurea cyanus* of botanists, a common plant in corn-fields, provincially called blue-bottle.

CYATHEA (Smith). A West-India fern, of tree-like stature, and highly ornamental. It was described as a *Sphaeropteris* by Bernhardt and Wallich, and *Peranema* by Don.

CYBIUM, a genus of spinous-finned fishes, belonging to the mackerel family, *SCOMBEROIDÆ*, which see.

CYCADEÆ,—the *Cycas* family. A natural order of dicotyledonous monochlamydeous plants, containing two genera, and nearly thirty known species. Much difference of opinion has existed among botanists as to the particular situation which this order ought to occupy in the natural system. By some it has been included in the monocotyledonous or endogenous class of vegetables. In so doing these authors have laboured under an obvious misapprehension as to the real structure of the cycadæ. The order may be said to have a nearly equal relation to the flowering or flowerless plants; agreeing with the former in the presence of the sexes and the completeness of the vascular tissue, and with some of the latter, such as ferns, in the peculiar gyrate venation of the leaves, and the imperfection of the spiral vessels. By Lindley, *Cycadææ* are included along with *Coniferæ* under a section of vascular plants, to which he has applied

the name *Gymnospermæ*, and which are distinguished by the seeds being naked, and the vessels of the wood having large apparent perforations, to which nothing similar is seen elsewhere.

This order was by some botanists in former times included under the fern tribe, in consequence chiefly of the mode in which the leaves are developed. Linnæus originally considered it as belonging to the palm tribe, to which it appears at first sight to have an affinity in its large pinnated leaves, and simple cylindrical stem. It differs, however, totally from palms, in being dicotyledonous, and in having an essentially exogenous stem, a gyrate vernatim and naked seeds, which grow on the margin of a contracted leaf. The order to which *Cycadeæ* bears the closest resemblance is *Coniferæ*, or the pine tribe. With this order it agrees in the structure of its seeds, the form of its inflorescence, the arrangement of the veins of the leaves, the imperfect development of spiral vessels, and the apparent perforation of the vessels of the wood.

The essential characters by which the order is distinguished and separated from all others are: Flowers naked, diœcious, terminal; sterile flowers monandrous, collected into eones, each floret consisting of a single scale or anther, bearing the pollen on its under surface in two-celled cases; fertile flowers, either collected into eones or surrounding the central bud in the form of contracted leaves without pinnæ, bearing the ovules on their margin; ovules solitary, naked, with no other pericarp or covering than the scales or contracted leaves upon which they are situated; seed with a horny integument; albumen fleshy, solid; embryo inverted, the radicle being next the apex of the seed, from which it hangs by a long stalk or funiculus with which it has an organic connection.

The plants belonging to the order are trees with a cylindrical undivided trunk, increasing by the development of a single terminal bud, and covered with the scaly bases of the leaves, which are pinnated, with a gyrate vernatim and parallel veins. They are natives of tropical regions, and are found in America and Asia. They also grow at the Cape of Good Hope, and in Madagascar. In general they possess mucilaginous properties.

The genera of the order are cycas and *Zamia*.

Cycas circinalis, broad-leaved cycas, is a native of the East Indies, especially the Molucca Islands, where it attains a height of fifteen or twenty feet. The tree is called *Indu* by the natives. Its trunk is covered with the scars whence the old leaves have fallen, and from the top of the stem grows a crown of most beautiful foliage. It bears a drupaceous, smooth, reddish, orange fruit about the size of a walnut. The outer pulpy portion is about half an inch thick, and surrounds the inner horny coat, which covers a beautiful membranaceous lining of a rich brown colour. The tree was introduced into Britain by the Earl of Clarendon in the year 1700. It is very ornamental in our green-houses, but requires much space for the full display of its leaves.

The fruit of the tree is used in India as an article of food. From the soft centre of the stem a farinaceous substance is procured in many respects similar to the sago obtained from the sago palm. In preparing this substance, the stem is cut into pieces, several feet long, which are afterwards split longitudinally, so as to expose the pith; this is taken out, mixed with cold water, and then beaten with a wooden

pestle in a large mortar or trough. The mixture, after being allowed to stand for some time, gradually deposits a sediment, which is easily separated by decantation. This substance which may be denominated spurious sago, is merely the starch contained in the pith.

The nuts after being dried for a month in the sun, are beaten in a mortar, so as to separate the kernels, which are afterwards made into a kind of flour: much used by poor people in India as a nutritious article of diet, and called by them *Indum podi*.

In some Catholic countries the leaves of this plant are carried in procession, and used to adorn temples on Palm Sunday, in place of those of the date palm.

Cycas revoluta, revolute-leaved cycas, is a native of China and Japan, where it attains the height of five or six feet. It produces leaves four or five feet in length, which crown the trunk and form a magnificent basin ten or twelve feet broad at the base. The tree produces an orange-coloured drupe, nearly as large as an apricot, containing much white transparent mucilage, and enclosing an oval-shaped nut. The fruit has a mealy sweetish taste, and is eaten by the Japanese.

From the pith of the young stem of this species also, a kind of sago is procured, which is highly esteemed in the countries where the tree grows.

The plant is cultivated in stoves in this country, into which it was introduced in 1799.

Cycas inermis is another species found wild in China, where it is also much cultivated for its beauty. Its trunk is five feet high, and it bears an egg-shaped fruit of a red colour. In Tonquin, a valuable sago is made from the pith.

The genus *Zamia* resembles the last in many respects. It includes upwards of twenty species.

Zamia spiralis, yields large nuts, which are said to be eaten roasted by the natives of New South Wales. *Zamia cycadis*, bread-tree *Zamia*, is a native of Southern Africa. By the Caffres and Hottentots the pith of the tree after being buried in the earth for some time, is made into cakes which are used for food.

CYCHRUS (Fabricius). A genus of coleopterous insects belonging to the section *Pentamera* and family *Carabidæ*. These insects are of a moderate size, having the body robust and destitute of wings, the upper lip notched, the upper jaws long and rather slender, the maxillary and labial palpi with the last joint large and spoon shaped, the tarsi are alike in both sexes, and the body is much narrowed in front. They are generally of a black colour, and are found under the bark of decaying trees, and beneath moss and dry leaves lying at their roots, more especially in mountainous regions. They appear exclusively to inhabit Europe, Asiatic Russia, and North America. Dejean describes nine species, but there is only one indigenous to this country, namely, the *Rostratus* of Linnæus, a species having so much resemblance to some of the darkling beetles (*Melasma*) that Linnæus was misled as to its true relationship with the *Carabi*, and placed it in the genus *Tenebrio*. The robust structure of the mouth, however, and especially the great development of the palpi, prove that its habits are not less ravenous than the remainder of the family to which it belongs. It is found not uncommonly in the spring under dead leaves in the woods and commons near London, and is about three quarters of an inch long, and of a black colour, the elytra having a granulated appearance. It owes its specific name to

the front of the head being elongated into a kind of beak. Two other species, *C. clongatus* and *attenuatus*, have been mentioned as inhabitants of this country, but without sufficient authority.

CYCHLA, a genus of spinous-finned fishes, belonging to the family LABROIDÆ, which see.

CYCLAMEN (Linnæus). A genus of European tuberous rooted herbs, cultivated for the beauty of their flowers. The genus belongs to *Pentandria Monogynia*, and to the natural order *Primulaceæ*. Generic character: calyx bell-shaped, divided half way down into five parts; corolla base swollen, throat a little prominent, segments of the limb reflexed; stamens borne on small filaments inserted in the tube; anthers connivent and arrow-shaped; style filiform and protruding; seed-vessel a berry, but opening at last into five parts; seeds seated in the pulp. These plants were called sow-bread by the ancients, in allusion to the tubers being sought for and eaten by hogs. The Persian is the only greenhouse species, but all deserve to be kept in pots, and placed where they may be seen to most advantage. They yield abundance of seeds by which they are easily increased, provided the seed is sown soon as it is ripe.

CYCLAS (Lamarck), TELLINA (Linnæus). This genus of molluscs has been separated from the genus *Tellina*, in consequence of certain well-defined distinction: these, nevertheless, though sufficient to separate them from that genus, have led to some speculation on the part of modern malacologists; and we find in the French school that the genus *Cyrcna* of Lamarck, the genus *Cornea* and *Corbicula* of Megerle, and the *Galathea* of Cuvier, are all considered as subdivisions of the genus *Cyclas*; and though we do not advocate an useless multiplication of genera, we cannot altogether agree with that arrangement; however, as the general habits of these molluscs, as well as their organisation, nearly correspond, we give the following description in accordance to the French school:—The shells of this genus are small, of a very convex oval form; valves very thin, and always without three primary teeth on either of them; apices never eroded or decorticated; some species are so thin and fragile as to be transparent; the valves smooth or transversely striated; shell transverse, equivalve, apices protuberant; primary teeth very small, almost obsolete, sometimes two on each valve, of which one is plaited in the middle of the one valve, and sometimes two plaited or folded teeth on the other. These constitute Lamarck's genus *Cyclas*. Such species as have a suborbicular form, the cardinal teeth rather variable, and always very small, if not altogether obsolete, with the apices not eroded, form the genus *Cornea* of Megerle. The species of a subtrigonal, or an elongated oval shape, having the apices eroded, and more anterior, with three cardinal teeth, the two posterior of which are bifid, constitute Lamarck's genus *Cyrcna*, and those having the lateral teeth dentated, but corresponding in other respects, form the genus *Corbicula* of Megerle. The species of a subtrigonal form, with two-grooved cardinal teeth on one valve, three on the other, the middle one being larger and callous, form Lamarck's genus, *Galathea*. All these molluscs inhabit fresh water, generally buried in the mud; the two last sections only are known in Europe: the greater number of the others being from the Indian rivers, but every part of the world presents species of the first division; the shells are generally provided with an epidermal coat. The

animal has its body of an oval form, the edges of the mantle plain, the tubes short and united, the foot large, compressed at its base, and terminated by a species of foot, or appendage answering that purpose. This genus is classed in the third class *Acciphalophora*, third order *Lamellibranchiata*, eighth family *Conchacea*.

CYCLICA (Latreille). An extensive division of coleopterous insects belonging to the section *Tetramera*, distinguished by the generally short and rounded form of the body. They differ from the *Rhyncophora* or weevils, in not having the head produced into a rostrum; from the *Xylophaga*, by having the antennæ not clavate; from the *Platysoma*, by the body not being flattened; from the *Longicornes*, in the antennæ being shorter than the body; and from the *Eupoda*, in having the hinder part of the thorax as wide as the base of the elytra.

For the particular characters of this division as well as for an account of the families of which it is composed, we must refer to our article headed *CHRY-SOMELIDÆ*, where, in consequence of this division nearly corresponding with the Linnæan genus *Chrysomela*, we have thought it more convenient to give a description of this group.

CYCLOBRANCHIATA is the name given to an order of molluscs having the organs of respiration branchial, in the form of tufts, more or less developed, symmetrically arranged near the vent, which is situated in the median line of the posterior part of the animal's body. The skin is naked, though sometimes tuberculated. This order includes the genera *Doris*, *Onchidoris*, and *Peronia*; of the second class, *Paracephalophora*. they will be described in their respective places.

CYCLOPS (Muller). A genus of minute aquatic crustaceous animals, considered by M. Edwards as entitled to the rank of an order, to which he has given the name of *Copepoda*. These little creatures, which abound in fresh and standing waters, are seldom more than one-eighth of an inch long, and may constantly be observed jerking about by the assistance of their long tails. In their forms they somewhat resemble a lobster in miniature, the thoracic part of the body being of an oval form, furnished with a single eye in front (whence the generic name of the group). This part of the body is divided at its hinder part into several segments, which are succeeded by an articulated tail or abdomen, from the base of which in the females depends on each side a large membranous bag containing the eggs. The abdomen is forked at its extremity, each division being furnished with strong setæ; the upper antennæ are very long and multiarticulate, but the inferior are short and four-jointed. The legs, which are very short, consist of five pairs, each leg being divided into two cylindrical branches. From their curious forms, great agility, and odd motions, these little insects form conspicuous objects in the exhibitions of the solar microscope, with which instrument so much instruction and amusement is capable of being produced. The upper and long antennæ perform the offices of legs, and the lower pair of these organs, from their being kept in a continual rapid motion, produce a kind of whirlpool, which brings into its vortex the minute particles upon which they feed. At the period of coupling the males are extremely active. The eggs which are of a brown, blue or green colour, varying according to their age, become transparent when nearly ready to

produce the young; and it is an extremely curious circumstance, which has been well confirmed, that a single act of impregnation is sufficient for several successive generations. A female cyclops in the space of three months gives birth to not less than ten distinct broods; and if we calculate only eight broods, each having only forty young, it will be seen how immense must be the increase of these creatures. The duration of the egg state varies from two to ten days, according to circumstances, such as the degree of temperature, the period of the year, &c. When hatched, the young have only four legs, with the body of a rounded form, and destitute of tail. Muller, the celebrated Danish writer upon these and other allied animals, not knowing them to be the young of the cyclops, formed them into a distinct genus with the name of *Amymone*. Shortly afterwards they acquire an additional pair of legs, and these for the same reason were formed by the same author into the genus *Nauplius*. After the first shedding of their skin they are said to possess all the organs of their perfect form, but of a diminished size, especially as regards the antennæ and legs; and that after the third moulting they become adult; but in this manner of reckoning it will follow that two pairs of legs must be developed without a corresponding moulting having taken place, and this is so contrary to what is observed amongst the invertebrated animals that the correctness of such observation may perhaps be questioned. The chief food of these animals consists of minute particles of animal matter floating in the water, but in default of this they will feed upon vegetable substances in a decaying state. When one of the antennæ is cut off no change at first takes place, but at the following moulting the loss is repaired by the production of a new antenna.

There are numerous species belonging to this group, of which the *Monoculus quadricornis* of Linnæus (a name improperly changed by Dr. Leach to *C. vulgaris*) is the type; it is very variable in its colours, being sometimes reddish, at others green, bluish, or whitish. It is a very common species. Some of the species (forming the genus *Calanus* of Dr. Leach, including the *C. finmarchianus* of Muller,) have the inferior antennæ obsolete, whilst others (forming our genus *Canthocampus*, having for its type the *C. staphylinus*), have the abdomen of the females recurved with a spine beneath at the base, and in some there is but a single egg-pouch (forming our genus *Diaptomus*), and of which the *C. castor* is the type.

CYCLOPTERUS, a genus of soft-finned fishes, belonging to the order with the ventral fins under the pectorals, and to the third family of the order *Discoboles*, and including the lump-fish and some others. The following are their most remarkable generic characters:—

The rays of the ventral fins are dispersed all round the lower part of the thorax, and united by a single membrane of considerable strength into a concave oval disc, which the fish employs as a sucker for attaching itself to the rocks. This is their most remarkable character; and it is from it that they get the name of *Cyclopterus*, or fin all round. Their other characters in brief are: the mouth very large, with small pointed teeth in both jaws, and also in the pharynx; their gill lids small, their gill flaps with six rays; their pectorals very large and united below the throat so as to unite with the disc formed by the ventrals; their skeleton is soft and very imperfectly ossi-

fied; and their skin viscous and without scales, but powdered over with small hard grains. Their stomach is large with numerous cæca; their intestine and air bladder of mean size. They are usually divided into two sub-genera, the chief distinction being the form of the dorsal fin.

1. LUMP FISHES. These have a first dorsal fin more or less visible, but always very low and with simple rays; the second dorsal has the rays articulated, and is placed immediately over the anal fin, the body of these fishes is very thick and clumsy, and also very soft, and not very manageable in the water; but they are enabled to hold on upon the rocks by means of the ventral disc, and thus catch the food which is brought to them by the current of the water, and they are much less liable to be injured by the current beating them against the rocks than if their bodies were of firmer texture.

COMMON LUMP FISH (*Cyclopterus lumpus*). This species is common on all the coasts of the British islands, and in most parts of the North Seas. The back is sharp and raised, the belly flat, the body of the fish deep, the dorsal and anal fins short, and the sides marked with rows of osseous tubercles. The length is usually about eighteen inches; the colours—dusky on the back, and red on the under part; the flesh is soft, oily, and tasteless, and seldom used as human food; but as the fish is as lumpish in its motions as in its form, it very readily falls a prey to sharks, seals, and other predatory inhabitants of the waters. It is not understood to eat fish, but rather medusæ and other soft and gelatinous animals which float about freely in the water, and are brought to the eddies where it fastens itself upon the rocks. It is sometimes apt to vary in colour, and hence there are different names for it. There are, also, however, one or two smaller species, all inhabiting the North Seas, but of no use or interest whatever.

2. CYCLOGASTER. These have one dorsal fin, of the same length as the animal. Their bodies are smooth, elongated backwards, and considerably compressed, and they are much more active than the former subgenus.

SEA MOUSE (*Cyclopterus musculus*). This is a small fish, about seven or eight inches in length, found on the shores of the Channel; and gets its common name from its colour and the activity of its motions.

THE LIPARIS (*Cyclopterus liparis*). This species grows to a much greater size than the former, being frequently eighteen inches in length. It is a very northerly fish, and found on the icy coasts, though it sometimes makes an excursion as far southward as the shores of England and France. Its muzzle is rounded; its head broad and flat; its mouth large with two small fleshy beards to the upper lip. The back and fins are brown, the sides yellow, and the belly white. The flesh of this species is eaten by some of the northern people, but it is of very inferior quality. There is another species found in the north, chiefly in the White Sea, which is different from this, and has been called *Cyclopterus linetus*, the sides of this species are striped longitudinally with brown and white, and it differs from the former in a few other particulars; but it is a fish of no interest or value.

CYCLOSTOMA (modern authors), (*Helix* of Linnæus, *Turbo* of Muller). The shells constituting this genus are all of them terrestrial, and from the

great variety of their forms have been blended by former writers on conchology with other genera. It now, however, comprehends a well-defined separation from the *Helices*, being easily distinguished by the aperture or mouth being constantly circular, whence the name is derived: the margin is thin, sharp, and outwardly reflexed at right angles with it. The genus *Cyclostoma* is not, however, the only species of mollusc possessing a round mouth; the *Scaloria*, *Delphinula*, and *Paludina*, have it also; the two former have likewise the reflexed lip, but the annular processes or previous terminations of the aperture in the *Scaloria*, and the pearly substance of the other, distinguish and prove them to be marine; while the *Paludina*, not possessing a reflexed lip, but a smooth, sharp margin, is evidently a fluviatile shell. These molluscs vary considerably in form, some being turrit, some quite cylindrical, others flat at the spire, or convex, and can only be recognised with certainty by their round aperture and reflexed lip. Their exterior never having tubercles or spines, and by their possessing a perfect calcareous operculum, not spiral, and the summit sub-central, another distinguishing character may be observed in the left side of the aperture, having its origin much detached from the spire. The genus is subdivided into such species as have the spire slightly elevated, as in the *C. elegans*; those whose spire is very prominent, as in the *C. fasciata*; those umbilicated and trochiform, as the *C. rotvulus*; and, lastly, such as are much depressed, and planorbicular, as the *C. planorbicula*. They inhabit the Indian, African, and American continents; and about twenty-five recent species are described, with eight or ten fossil.

CYDONIA (Tournefort) is the common quince of gardens. It is said to be a native of Cydon in Crete, hence the generic name. The quince is too austere in flavour, and disagreeable in scent, to be regarded as a table fruit, but it is useful in combination with others for adding a piquant flavour, and it is also useful for several purposes of the confectioner.

It may be propagated by cuttings, layers, or by suckers, which rise from the root. The tree is of a middling size, and very irregular growth, requiring pruning to keep it in form. It is just possible that this beautiful fruit may be capable of amelioration by cross impregnation with the pear. The only difficulty in the way of accomplishing this result is that the trees do not flower at the same time, so that some management must be had recourse to either to accelerate the flowering of the quince or retard that of the pear. Whether such a thing be practicable we have yet to learn, but the thing deserves consideration.

There are four varieties of the quince, viz. the pear-shaped, the apple-shaped, the Portugal, and the eatable. The Portugal is preferred for marmalade, it yielding a higher colour. They may be grafted on each other, and all thrive in any kind of loamy soil. Quince stocks are often used by nurserymen for some particular sorts of pears, on which they do better than on their own stocks.

CYMBIDIUM (Swartz). A genus of fine flowering and sweet-scented herbaceous perennials, natives of China and both Indies. The flowers are gynandrous, and of course the plants belong to the natural order *Orchideæ*. Generic character: sepals distinct, spreading and gaping; three superior ones somewhat hollow and broad, inferior, narrow, and deflexed. Labellum concave, rather lobed, articulated with the base of

the column. Column jointed, winged, and obtuse; anthers terminate and hooded; pollen masses behind in two lobes joined to glands. Some of the species of this genus are remarkable for the brown colour of their flowers, and their night-evolved perfume. The *C. Sinense* is a strong-rooted bulky plant, and requires a large pot to allow vigorous growth in order to flower strongly. This is a great favourite among the Chinese, who grow them well; very fine ones are sometimes valued at 100 dollars! Of such the flower scape or stem rises to the height of four or five feet, with flowers from bottom to the top. This plant is an instance of that remarkable property in all flowers of a brown colour, being most odorous by night. The cymbidiums require to be planted in sandy loam and moor earth, and grown in a pit or frame, and removed into the greenhouse or conservatory when in flower.

CYMBULIA (Peron, Lamarck). A cartilaginous shell of crystalline transparency and firm consistency, in the form of an elongated slipper, or French wooden shoe (sabot), truncated at the summit with a lateral opening at the anterior part, conical at the posterior where the animal adheres, having the faculty of concealing itself altogether in its glassy covering. The animal's body is sub-cylindrical, provided backward with a filament, by which it is attached to the shell; on each side is a large natatory appendage; it has two eyes and a kind of proboscis. It is arranged in the second class, *Paracephalophora*, first order *Aporobranchiata*, first family *Thecosomata*.

CYMOTHOIDÆ (Leach). A family of crustaceous animals, belonging to the division *Edriophthalma*, and order *Isopoda*, and distinguished by having the antennæ short, and inserted in pairs one above the other. The body is of an oval form, convex or depressed, the abdominal portion divided into several segments, of which the basal ones are very short, and the terminal one large and broad; the legs are short, and very robust, being terminated by a hooked joint. These animals composed the Fabrician genus *Cymothoa*, but were arranged by Linnæus under the genus *Oniscus*. They have, indeed, somewhat the appearance of wood-lice, but their habits are very distinct, being parasitic upon various kinds of fishes inhabiting the ocean, to which they attach themselves by means of their strong-hooked feet, and then suck their blood; hence the ancients gave them the names of *Æstrus* and *Asilus*, from the resemblance between their habits and those of the brecze flies. On the under side of the body of the females are fixed several membranous pectoral imbricated scales, covering the eggs, and in which the young are hatched. Dr. Leach divided this group of animals into numerous genera, but which may be reduced to those of *Serolis* (having the eyes placed upon tubercles), *Nelocyra*, and *Cymothoa*, to which *Synodus* and *Limnoria* may be added. The last-named genus comprises a minute animal, which burrows into the wood of which the submarine buildings of several of our dockyards are composed, committing great devastation in such situations. In the genus *Cymothoa* the eyes are not elevated on tubercles, and are formed of minute facets; the abdomen is six-jointed, and the mandibles not projected. The type of this genus is the *Oniscus æstrum* (Linnæus), a species known to Aristotle, who says of it—"Fishes are attacked by a sea-louse, which is not produced from the fish, but from the mud." It resembles a wood-louse, but the tail is larger.

CYNANCHIUM (Linnæus). A genus of herbs and climbing perennials, natives of many different parts of the world. Linnæan class and order *Pentandria Digynia*, and natural order *Asclepiadææ*. Generic character: corolla five-cleft and rotate; corona like petals, alternating with anthers, or simply five-lobed; or double, in which case the exterior is ten and interior five cleft. Some few of the species were formerly called *Asclepias*, and are hardy; some are stove, others greenhouse plants. They may all be increased by cuttings or divisions of the roots.

CYNARA (Linnæus) is the generic name of the **ARTICHOKE**, which see.

CYNIPIDÆ, Nob.; (*Diplolepariæ*, Latreille). A family of hymenopterous insects, belonging to the section *Securifera* (or those which are not furnished with a poisonous sting), and placed by Latreille in the midst of his group of parasitic species, which he has termed *Pupivora*, notwithstanding the circumstances that the species of which the family is composed are herbivorous in their larva state. These insects are small four-winged flies, formed by Linnæus into the genus *Cynips*. The wings are furnished with but few nerves, the lower pair having but a single longitudinal nervure; the antennæ are moderately long and slender, or slightly thickened at the tips, and composed of from thirteen to fifteen joints, not being elbowed in the middle. The abdomen is short, compressed, and of a rounded form, and the ovipositor, which is rather long, is rolled in a spiral manner within the curve of this part of the body, its extremity being only exposed, and which, when not in action, is lodged in a groove at the extremity, formed of two flattened plates.

Much confusion has occurred in the name of this group of insects owing to the incorrect nomenclature introduced by Geoffroy, and adopted by Latreille, the Linnæan name *Cynips* having been applied to the insects composing our family *Chalcididæ* (which see), and the new name of *Diplolepis* given to the Linnæan *Cynipes*. In a paper upon this subject, published in the *Zoological Journal*, the author of this article corrected this synonyme, and has the gratification to have been followed by Latreille in his last work, where the family *Chalcididæ* is described under the name of *Chalcidites*, although the gall-flies, instead of being similarly named *Cynipites*, are termed *Gallicolæ*, in allusion to the habits of the family, of which the species, or at least their retreats, are well known to every observer of nature under the form of galls and excrescences of different shapes upon various kinds of trees. The insects are of small size, and, as it were, hunch-backed, owing to the small size and low position of the head, and the elevated thorax. The galls which we have mentioned are the result of wounds inflicted by the parent *Cynips* upon the leaves, or bark of various plants, in the act of depositing her eggs, and which are thrust into the wound thus made. How their growth, however, is effected, is a point in the natural history of these insects not yet determined, and it is only by the microscopic observation of some of our vegetable physiologists that we can hope to obtain a satisfactory solution of the question. It is indeed difficult to conceive how a minute egg, deposited in the middle of a leaf, shall, in a short time, be found removed from such situation, and fixed in the centre of a vegetable mass, sometimes as much as an inch from its original position, such mass being in some cases dependent from the leaf at the extre-

mity of a slender thread, somewhat like a cherry at the end of its stalk. It is equally curious to consider the great virulence of the fluid deposited by the parent with the egg, and which has evidently the effect of irritating the plant to such a degree as to cause it to throw out these monstrous appendages. It was indeed supposed by the early naturalists that these galls were caused by the larvæ when newly hatched, gnawing the leaf, thereby causing its juices to flow, by which it was soon surrounded, and which soon became inspissated; but as the galls are often found fully formed even before the egg is hatched, this opinion is untenable. But, even to the philosophical Redi, these insects proved a stumbling block; for, notwithstanding all his splendid discoveries and observations, whereby he so satisfactorily disproved the doctrine of spontaneous generation, he fell into the strange idea, in order to account for the development of these galls, that there existed in the trees and plants a vegetative kind of power, or soul, charged with the care of producing the grubs; and if, says Reaumur, we are not disposed to admit that a merely vegetative power would produce a gall and a gall-worm, he was even disposed to believe it to be still more sensitive. How humiliating is it to the proud intellectual powers of the mind, that so absurd an idea could have entered into the mind of Redi. Our great philosopher, John Ray, after noticing this fancy of Redi, and the received opinion that some insects were produced from plants, tells us that "Signior Malpighi, in his *Treatise of Galls*, under which name he comprehends all preternatural and morbose tumours and excrescences of plants, doth demonstrate, in particular, that all such warts, tumours, and excrescences where any insects are found, are excited or raised up either by some venenose liquid, which, together with their eggs, such insects shed upon the leaves, or buds, or fruits of plants, or, boring with their terebræ, instil into the very pulp of such buds or fruits, or, by the contagious vapour of the very eggs themselves, producing a mortification or syderation in the parts of plants on which they are laid; or lastly, by the grubs or maggots hatched of the eggs laid there, making their way with their teeth into the buds, leaves, or fruit, or even the wood itself of such plants on which the eggs were laid. We conclude, therefore, that galls and other tumours of plants are nothing else but morbose excrescences raised up by the force of the egg there laid, disturbing the vegetation and temper of the plants, and perverting the motion of their humours and juices, wherein the inclosed eggs and animalcules are cherished, nourished, and augmented, till their proper parts being manifested, explicated, and hardened and strengthened, they are, as it were, new born, affecting to come forth into the open air."—*Wisdom of God*, p. 249.

Some authors have considered that these galls are leaves or buds modified into galls by the action of the stimulating matter left in the wounds, whilst a more recent writer has supposed the orifice of the wound or the egg itself to be covered with gluten*, which gluten prevents the sap that flows through the puncture from being scattered over the leaf, and the sap being thus confined to the space occupied by the eggs, will expand and force outwards the pellicle of gluten that confines it, (and which, of course, forms a

* We do not well understand how the sap can flow through a puncture stopped with gluten.

covering or coating to the entire gall,) till becoming thickened by evaporation and exposure to the air, it at length shuts up the puncture, stops the further escape of the sap, and the process is completed. When, however, we consider the large size of some of these galls and the very minute quantity of gluten which must be deposited with it, we do not see sufficient cause for adopting this idea; moreover we cannot but suppose that a more irritating fluid than mere gluten is deposited, in order to produce such active and violent effects upon the plant. If, indeed, the *Cynips* did not belong to the *Hymenoptera*, we might feel less hesitation in thus expressing ourselves; but when we know, from experience, the poisonous fluid with which even the terebrant *Hymenoptera* are furnished, it is difficult not to believe that it is to this stimulus that the production of these galls are attributable; but, again, admitting the orifice to be stopped by gluten, we see but little difficulty in supposing that the vegetative matter, of which the gall is formed, should not require a coating of gluten any more than though it were a leaf or a bud. But when this theory is applied in detail, we find it still more untenable; indeed, its author was obliged to admit that, in the hairy bedeguar gall of the rose, "the gluten, it would appear, is not sufficiently tenacious to confine the flowing sap within the dimensions of any of the little clustered globes containing the eggs, for it oozes out from numerous cracks or pores in the pellicle," and "shoots into a reddish-coloured fibrous bristle:"—and from the natural tendency of the sap of the rose-tree to form prickles, these are all studded over with weak pricklets; which formation is supposed to be of great utility by affording warmth during the winter to the enclosed insects. Without stopping to inquire why the gluten of the bedeguar should not be as strong as that of the much larger oak gall, we will only observe, in conclusion, that the circumstance that many of the different kinds of galls are so irregular in their forms, bearing resemblance to leaves and buds, that it is impossible to apply to them, or indeed to any other than perfectly globular galls, the theory of the gluten: and it is not philosophical to suppose that the globular galls should be produced by one operation, and the other kinds by a distinct one.

One of the best known species of galls is that employed in the manufacture of ink, and which is found upon the oaks growing in the Levant. This gall is of a globular form, and on opening it, its interior will be found to be of a very solid consistence, having a rounded cell in the centre, in which the fly (*Cynips gallæ tinctoriæ*) in its winged state may often be found. The form and solidity of galls vary according to the situations in which they are found, as the leaves, peduncles, buds, bark, root, &c.: some being round, others irregular, some smooth, others covered with hair, whilst many resemble buds or minute artichokes; their size is also very varied*.

It is a curious circumstance that the eggs of these gall-flies, like those of the saw-flies, increase considerably in size previous to the exclusion of the larva, which is sufficient to show that the membranous covering in which they are enclosed is of a very different texture from that which envelops the eggs of insects in general. The larva hatched from these

eggs are white, fleshy, inactive grubs, destitute of legs, which would, of course, be useless to them, but provided with jaws for eating the hard substance of the gall. Sometimes one only inhabits a single gall, but in others a single gall is the abode of numerous larvæ. In some species the larvæ undergo their transformations, and the perfect insect is produced within the gall; but in others the larvæ make their way out of the gall when full-grown, and fall to the earth, where they become pupæ. The exit of the insect in either state from the gall is indicated by a small circular orifice at the side of the gall. These gall insects are much subject to the attacks of a parasitic group of flies, of nearly the same size, belonging to the family *Chalcididæ*, and having the ovipositor long and exerted, their colours being highly metallic and beautiful; they compose the genus *Callimome*.

One of the species of this genus is employed in Greece in a very serviceable manner for hastening the maturity of the fig. This species, which is the *Cynips psenes*, deposits its eggs in the seed vessel of this plant, and the inhabitants place a quantity of the early figs which had been attacked in the neighbourhood of the more tardy ones; so that the insects when quitting the former, covered with the fecundatory dust, introduce themselves into the latter, so as to cause the more speedy ripening of the fruit. This process is termed caprification.

Hitherto all the species of this family have been considered as inhabiting galls, but in a memoir which the author of this article has lately published in the Magazine of Natural History, we have given the history of a species which we discovered to be parasitic upon the aphides of the rose, in which respects it forms an interesting point of connection between such of the *Ichneumonidæ*, as the *Aphidius*, (see *BRACONIDÆ*), and the true gall-flies.



Oak-apple gall and *Cynips quercusfolii*.

The family comprises the genera *Cynips*, *Figites*, *Ibalia*, *Anacharis*, and a few others, which we have proposed in the memoir above referred to; these genera rest chiefly upon structural differences. The typical genus, *Cynips*, has the abdomen compressed and the antennæ filiform; the submarginal cells are three in number. The oak-apples are produced from one of the species of this genus, *Cynips quercusfolii*, and the bedeguar, (which see,) is the result of the wounds of the *Cynips rosæ*, a species of moderate size, of black colour, having the legs and abdomen, except at the tip, red.

CYNOGLOSSUM (Linnæus). A genus of herbaceous herbs, mostly biennials, and natives of Europe. Two of the species are British, and called, from the shape of the leaves *Hound's-tongue*. It belongs to the fifth class and first order of Linnæus, and to the natural order *Boraginæ*. The cynoglossums are used as open border flowering plants, but do not possess much beauty. They are increased by seeds.

* We must refer to our article *CUPULIFERÆ* for various details relating to the economical usages to which galls are applied.

CYNOSURUS (Linnæus) is the dog's-tail grass of British farmers, and a useful grass both in meadows and pastures, and when prevalent enhances the value of hay.

CYNTHIA, (Fabricius). A handsome genus of lepidopterous insects, belonging to the section *Diurna*, and family *Nymphalidæ*, having the wings scalloped, the anterior triangular, and somewhat hooked; the antennæ have an abrupt, short, terminal club; the larva is spinose, and the chrysalis ornamented with golden spots, and of an angulated form. The only British species is the *Papilio cardui* of Linnæus, termed the painted lady; it is of a rosy buff colour, with black and white markings, the lower wings being marbled beneath, with four eyelets; the larva feeds solitarily upon various kinds of thistles, nettles, &c. beneath a silken web; the chrysalis is of a greyish colour. It appears in the spring, and again in August, but its appearance is very irregular, several seasons intervening before it is again met with. This is one of those species which with certain trifling alterations are met with in almost every quarter of the globe.

CYPELLA (Herbert). A bulbous-stemmed herbaceous perennial, introduced into this country from Buenos Ayres. It belongs to *Irideæ*. This bulb requires to be planted in a warm border, where it flowers and ripens seed in summer, but should be protected from frost in winter.

CYPERACEÆ—the sedge family. A natural order of monocotyledonous or endogenous plants containing nearly thirty genera, and between four and five hundred known species. It bears a strong affinity to *Gramineæ* or grasses, and by superficial observers would at once be referred to this family. It differs, however, in its solid and angular stem, in the absence of a diaphragm at the articulations, in the flowers being covered by a single bractea, and in the embryo lying at one end of the albumen, within which its cotyledonary extremity is included. In its general habit this order is also allied to *Juncææ* and *Restiaceæ*. Its essential characters are: flowers hermaphrodite or unisexual, each with a glume or chaffy scale; perianth either wanting or resembling bristles, rarely membranaceous; stamens hypogynous, definite, generally three; anthers fixed by their base, entire, two-celled; ovary one-seeded, often surrounded by bristles; ovule erect; style single, trifid, or bifid; stigmas undivided, occasionally bifid; fruit a crustaceous or hard nut; albumen of the same figure as the seed; embryo lenticular, undivided, enclosed within the base of the albumen; plumule inconspicuous.

The plants belonging to the order are herbs with fibrous roots, angular stems generally without joints, sheathing leaves, the sheath being entire, and spirate glumes, the lowermost of which are sometimes empty and sterile. They are extensively distributed all over the globe, and are found growing in marshes, ditches, and streams, in woods and meadows, on the sands of the sea-shore, and on the tops of mountains. In the northern regions, cyperaceæ are numerous, and bear nearly an equal proportion to the true grasses, but as we approach the equator the number of the species diminishes much, and at the same time the character of the genera becomes changed.

By some authors the order has been divided into four sections:—I. The true *Cyperaceæ*; II. *Scripeæ*; III. *Sclerineæ*; IV. *Caricinæ*. The chief genera are,

Cyperus, *Scirpus*, *Sclerina*, *Carex*, *Uncinia*, *Schænus*, *Rhynchospora*, *Eleocharis*, *Cladium*, *Mariscus*, *Eriophorum*, and *Kyllinga*.

The plants of this order possess in general mucilaginous and demulcent properties, but they are not much used in medicine. They are not celebrated for their nutritive qualities, and are scarcely eaten by cattle. In these respects a wide difference exists between them and the grasses. They are by no means ornamental, and are not used in agriculture. In some sandy districts they are useful in binding the soil.

Of the genus *Cyperus*, whence the name of the order is derived, there are 237 species already described, and of these only two are natives of Britain. Most of the species are tropical, and their number gradually diminishes as we recede from the tropics. Some of them yield tubers which are esculent.

The root of *Cyperus longus*, sweet cyperus or English galingale, has an agreeable aromatic odour and an astringent bitter taste, and has been used as a tonic and stomachic. *Cyperus rotundus*, a native of the south of Europe and Asia, produces bitter tuberos roots about the size of a nut, which are said to be employed successfully by the Hindoos in cases of cholera. On account of their fragrance they are used in Greece to keep away insects from clothes. The tubers of *C. perennis*, after being dried and powdered, are used by the Indian ladies for scouring and perfuming their hair. The root of *C. odoratus* has a fragrant odour and a warm aromatic taste. *C. hydra* is a troublesome weed in sugar plantations in the West Indies. The tubers of *C. esculentus* have an agreeable sweet taste, and are eaten in Spain, Italy, and Egypt. They consist of starch, fixed oil, sugar, albumen, gum, malic acid, vegeto-animal matter, and a substance analogous to tannin, various salts of potash and lime, and some oxide of iron. The starchy matter constitutes the chief portion of the root. The fixed oil which has an amber colour, and a slightly aromatic taste, forms a sixth part of it. In Germany the tubers when roasted are used as a substitute for coffee. *C. papyrus* is interesting on account of being the plant which yielded the papyrus of the Egyptians, whence the English word paper is derived. This plant is now rare in Egypt, and is not cultivated as in former times, when it constituted a source of riches to the inhabitants of the borders of the ancient lakes of Meuzaleh and Bourlos. It is still found growing in marshy places in some of the countries bordering on the Mediterranean. The papyrus or paper of the ancients was made from the cellular substance or inner rind of the stem, thin slices of which were laid over each other transversely, moistened and subjected to considerable pressure. They were afterwards exposed to the rays of the sun, so as to acquire a sufficient degree of dryness, and were ultimately sized. The slices cohered together by means of the mucilaginous matter which enters into their composition. This paper was formerly made on a large scale at Alexandria and other Egyptian cities, and yielded a considerable revenue both to the manufacturers and the government. The mode in which it was prepared was for a long time lost, and has been only recently discovered by some Egyptian travellers.

This plant was used by the Egyptians as medicine, food, and fuel. Sugar was procured from it, and its fibres were manufactured into canvas and ropes. The top of the stalk, with the umbel of flowers,

adorned the temples and crowned the statues of the gods. Boats were made from the plant, and its root was frequently chewed.

Scirpus is another genus of the order, some of the species of which are applied to economical uses. *Scirpus lacustris*, lake club-rush or bull-rush, is frequent on the margins of lakes and ponds in Britain. Its stems constitute a considerable article of trade in consequence of being used for mats, chair-bottoms, &c. They are employed by coopers to fill up the spaces between the seams of casks. *Scirpus maritimus*, another British species, is eaten by cattle. Its roots have been ground and used instead of flour in times of scarcity. *Scirpus tuberosus*, the water-chestnut of the Chinese, yields tubers which are eaten either boiled or raw. Many other species of the genus are used for domestic purposes, such as stuffing cushions, and forming the wicks of candles.

Eleocharis cæspitosus, scaly-stalked spike-rush, is abundant in moist heaths in this country. It is called *Deers'-hair* in the Highlands, and in spring yields an abundant food to sheep on the mountains.

The genus *Carex* furnishes numerous species which grow in swamps, bogs, fens, and marshes, and which are often with great difficulty distinguished by botanists. The known British species amount to sixty-three. With the exception of a few species, they are of little use or beauty. In Kent the larger species are used for tying hops to the poles. In Italy they are put between the staves of wine casks, and are used for the purpose of covering Florence flasks. The roots of *Carex arenaria*, *disticha*, *hirta*, are slightly aromatic, and possess diaphoretic and demulcent properties. They are used as a substitute for sarsaparilla, and are commonly known by the name of German sarsaparilla. The first of these species is common on the shores of Britain, and is useful in binding together the loose sand. *Carex sylvatica*, when carded and dressed, is used by the Laplanders to protect their feet from cold. *Carex Fraseri* is the handsomest species of the genus, resembling at a short distance, when in flower, some of the lily tribe.

The various species of *Eriophrium* receive the name of cotton grass, on account of the silky tufts of a wool-like substance which cover their seeds, and which render some of them peculiarly conspicuous in almost all marshy grounds in this country.

CYPHONIDÆ. A sub-family of coleopterous insects. See CABRIONIDÆ.

CYPRESS. See CUPRESSUS.

CYPRICARDIA (Lamarck), CHAMA (Gmelin). This genus of shells has been separated from the *Chamæ*, by Lamarck; it nearly approximates to the genus *Cardita* in form, but may be easily distinguished from it by having three teeth beneath the apices, like those of the *C. Venus*, in addition to the callous lengthened tooth or ridge; the ligament is very long, but slightly or not at all projecting, the abdominal impression sometimes placed anteriorly. The animal, according to Poli, is nearly similar to that of the *Cardita*, in consequence of which modern authors have made this genus a sub-division of the genus *Cardita*. The species appear to inhabit rocks, only occasionally covered by the influx of the tides, in the warm latitudes. The genus is placed in the third class, *Acephalophora*, second order *Rudista*, sixth family *Submytilacea*.

CYPRINA (Lamarck), VENUS (Linnæus). This genus of molluscs appears intermediate with the

genera *Cyclas* and *Venus*. The *Cyprinæ* are, in general, of a large size, much resembling the *Veneres*, but are distinguished from them by having one impressed lateral tooth on the front side, sometimes obsolete, the callosities of the hinge are large, arched, terminated near the apices by a cavity, sometimes very deep; the ligament is external, partly fixed beneath the apices. From the molluscs of this genus possessing a lateral tooth, though it is sometimes obsolete, and their being covered with an epidermis, they may be conjectured to inhabit rivers at their junction with the sea. The form of the shell is regular, longitudinally substriated, equivalve, inequilateral, the summits very much recurved forward and often contiguous; the muscular impressions sub-circular, very distant, united by a straight ligula, marginal, and a little sinuous towards the anterior; the impression of the retractor muscle, anterior to the foot, very large and united to that of the adductor muscle; the shell possesses an epidermis, and in substance it is thick and heavy. The animal has been described by Fabricius, but it requires a further knowledge of its organisation to enable us to adopt his definition, which is very obscure; it is, however, by analogous reasoning placed in the third class *Acephalophora*, second order *Rudista*, eighth family *Conchacea*. Not more than two or three recent species are known, and about seven fossil. It inhabits northern climates, and one species is a native of Iceland.

CYPRINOIDÆ—The Carp family. The first of the five families into which Cuvier divides his first order of soft-finned fishes, or those which have abdominal fins, that is, which have the ventral fins attached to the abdomen behind the pectorals, and unconnected with the bone of the shoulder.

This family have the mouth small, the jaws feeble, with little opening, and very often without teeth, but with teeth on the pharynx, which compensate a little for their absence from the jaws. Their bodies are scaly, and they have not the soft dorsal fin which is found in the salmon family. They are the least carnivorous of all the finny tribes. They are all inhabitants of the fresh water, and there is such resemblance among them, that it is often difficult to distinguish the one from the other. Most of them are esculent, but their flesh is not of the first quality. Cuvier divides them into eight genera: *Cyprinus*, the carp; *Cobitis*, loche; *Anableps*; *Pæcilia*; *Labias*; *Fundulus*; *Molinesia*; and *Cyprinodon*; some short account of each of which will be given in its place in the alphabetical order of this work.

The genus *Cyprinus* is farther divided into eleven sub-genera: *Carp*, properly so called, which is the typical sub-genus; *Barbus*, the barbel, of which an account will be found in the article BARBEL; *Gobio*, the gudgeon; *Tinca*, the tench; *Cirrhinus*; *Abrama*, the bream; *Labes*; *Catastomus*; *Leuciscus*; and *Gonorhynchus*. Some account of such of these as have any interest for the general reader, will also be found, either under their generic names, or their English ones, where they have any; and, therefore, the remainder of this short notice may be restricted to a very brief mention of carp, properly so called.

CARP (*Cyprinus*). These have the dorsal fin longer than the other, with a toothed spine for the second ray of the dorsal and caudal fin. Some have fleshy beards, or filaments at the angles of the upper jaw, and others are without.

COMMON CARP (*Cyprinus carpio*). This species

has four beards to the mouth, the lateral line a little bent, and the tail forked. It is not understood to be a native of England, but to have been introduced as a pond-fish about the latter part of the fifteenth century. It is found native in the lakes and ponds of the south of Europe, and it is much more common in France and in Germany than in this country. Its flesh is tolerably good, and it is serviceable as a pond-fish, because it is remarkably tenacious of life, and therefore can be carried over land from one place to another. Instances are mentioned of its having been carried alive from Strasburg to Paris, by keeping a little humid moss in contact with the gill-lids; and, indeed, it will live a long time without even that simple operation.

Carp is not a fish of the troubled waters, and its motions are as restrained as those of the element in which it lives. Placid streams, which creep along without any perceptible current, the moats and trenches of ruined castles, shaded and mantling ponds, which are left to the operations of nature, and in which aquatic plants accumulate, are the favourite localities of carp. It feeds quietly upon those submerged vegetables; and from the quietness of its habits, and the little fatigue which it undergoes, it lives to a great age, not less, it is said, than a hundred years, by which time its back is understood to get entirely white. It is not timid, but rather fond of society, and capable of being so far educated, as to come and be fed at stated hours, on being whistled to by its master. The stilly part of the Rhine, near Strasburg, contains immense numbers of carp, in which a considerable trade is carried on with Paris; and it is found as far to the eastward as Persia; but it is understood to prefer more temperate climates, and does not grow to so large a size in very warm countries. Specimens have been mentioned of nearly four feet in length, but it is rare to meet with one more than two. Though the carp feeds a good deal upon vegetable matter, it also eats worms and aquatic insects, and, as is sometimes said, it swallows the mud at the bottom of its haunts for the sake of the larvæ, and seeds which are contained in that. Hence the flavour of its flesh varies, much depending on the nature of its food. Carps spawn in June, and are very prolific.

Besides the common carp, there are mentioned; the *King of the Carps* (*Rex cyprinorum*), but it is doubtful whether this is a species; yet its scales are remarkably large, often an inch in length, and it appears to be more northerly than the other; also, the *Ann-Carolina* Carp, of Lacépède, a Chinese species, very handsome and beautifully coloured; and the *Green-violet*, of the same author; but little is known respecting them.

Of those which are without beards to the jaw, the most celebrated is—

The **GOLDEN CARP** (*Cyprinus auratus*). This is the well-known gold fish from China, and needs no description. A silver fish from Asia is also mentioned, but it is possible that this may be nothing more than the former discoloured by age.

CYPRIPEDIUM (Linnæus), is one of the most interesting of the *Orchideæ*. The *C. calceolus* is a native of Britain, and one of the most curious of her productions. Generic character: sepals patulate and distinct, the upper ones often united like a helmet, the two lateral ones divaricating; labellum inflated; upper part of the column trifid, lateral lobes bearing

anthers, middle one sterile and glandular; pollen granular. This, as well as the American species, should be planted in moor earth, in a frame or shady border, and defended from severe frost and heavy rain. They sometimes ripen seeds, by which they may be increased.

CYPRIS (Muller). A genus of minute crustaceous animals belonging to the sub-class *Entomostraca* and order *Branchiopoda* (which see). These little creatures swim about with great velocity in standing and fresh waters, their bodies being inclosed in a kind of bivalve case united by a hinge, which enables them to close their shells on the approach of danger. They have only six legs, and the antennæ are terminated by a whorl of hairs like a pencil; the body is without distinct articulation, terminated posteriorly by a soft tail. According to Jurine, who has observed these insects with much attention, the antennæ are employed in swimming, and the two fore legs are used when the animal creeps upon the surface of aquatic plants. He says that the second pair of legs are employed in establishing a motion in the fluid, whereby small particles of food are directed to the mouth; the tail is divided by two fillets, which are folded together when coming out of the shell; the eggs are enclosed in two large bags at the sides of the body beneath the shell: the female is occupied for about twelve hours in depositing them upon aquatic plants. As in the *Cyclops*, Jurine observed that several generations are capable of being produced without more than a single coupling having previously taken place. There are numerous species, inhabitants of our standing waters. The allied genus, *Cythera* of Muller, has eight legs, and the antennæ are not terminated by a brush; the species of this genus are confined to the salt water of the ocean.

CYRENA (Lamarck). A genus of shells, united to the genus *Cyclas* by de Blainville, of which he makes it a subdivision with considerable propriety. These shells are found in rapid rivers and streams; they are thick and solid shells, sometimes of great size; the apices eroded or carious, covered with a green or brownish epidermis, and admirably constructed to endure the rough treatment they experience from their peculiar habitations; their classification will be seen under the article *Cyclas*.

CYRTANDRACEÆ, a natural order of dicotyledonous plants, containing only a few genera and species. By Don and some other botanists it is denominated *Didymocarpeæ*. It is closely allied to *Gesneriæ*, from which, however, it differs in its deeply-lobed placentas, its siliquose fruit, and the want of albumen. It also bears a strong affinity to *Bignoniaceæ* and *Pedaliaceæ*, from which it is distinguished by its herbaceous growth, its minute, indefinite, wingless seeds, its one-celled ovary, and the membranous texture of its fruit and placentæ. Its essential characters are: calyx bell-shaped, five-lobed or five-leaved, equal; corolla tubular, irregular, five-lobed, somewhat two-lipped, the lobes imbricated in æstivation; stamens four, didynamous, of which two are sometimes sterile; anthers two-celled; ovary superior, elongated, surrounded by an annular disc, one-celled, with two many-seeded placentas, each of which consists of two diverging plates; style filiform; stigma two-lobed; and consisting of two plates; fruit capsular or succulent, the former siliquose and two-valved, one-celled, with double longitudinal placentas, which often cohere, so as to give the appearance of two cells; seeds very

numerous, minute, suspended, naked or connate; albumen none; embryo straight cylindrical; radicle next the hilum.

The plants belonging to the order are either terrestrial or parasitic, and usually herbaceous and stemless. They are sometimes shrubby; their leaves are generally opposite and radical, while their flowers are umbellate and often of a purple or pink colour.

They are found chiefly in the tropical regions of the Old World. Their properties have not as yet been determined.

The chief genera are *Cyrtandra*, *Didymocarpus*, *Chirita*, and *Incarvillea*.

CYRTANTHUS (Hortus Kewensis). A genus of Cape bulbs, belonging to *Hexandria Monogynia*, and to the natural order *Amaryllidæ*. Generic character: spatha few, or many-flowered on an umbel; corolla tubular, curved, enlarged above, limb erect and six-cleft; stamens inserted in the tube; filaments like threads; anthers ineumbent; style protruding; stigma trifid; seed-vessel three-celled. This genus, like many other bulbous plants from the same country, do well when grown in a pit or frame. While dormant, very little water should be given, but a large share when in full growth. Turfy loam and sand, or moor earth, is a suitable soil, and it is well to shift them just before they commence the summer growth. They are increased by seeds or offsets.

CYTHERIA (Lamarck), **VENUS** (Gmelin). This genus, notwithstanding the number of its species, was blended by Linnæus with the genus *Venus*, contributing to render that an overgrown and badly defined family. Lamarck observes that a great difficulty exists in discovering the characters of some of the species, the shades of difference between them being so slightly defined; he has, however, pointed out as a general guide to distinguish them from the genus *Venus*, that they have all of them four primary teeth on one valve, and only three united on the other, with an isolated cavity, oval, and parallel to the margin, the lateral teeth divergent to the summit. They are all marine shells, solid, regular, equivalve, inequilateral, apices equal, recurved, and slightly projecting. We are not positively determined upon the propriety of adopting this genus in its present form, but give Lamarck's definition until other reasons can be adduced for changing his arrangement. Our object being rather to illustrate the genera of modern authors than to introduce new ones of our own creation, which would lead to endless controversy, we nevertheless shall always freely express our opinion where it is founded upon our own experience, or the well authenticated observation of intelligent naturalists.

CYTINEÆ. A natural order of dicotyledonous plants, containing only a few genera and species. This order exhibits, in some degree, the structure of both the vascular or flowering, and the cellular, or flowerless class of vegetables—agreeing with the former in having a distinct floral envelope, and obvious sexual organs, and with the latter in the absence of spiral vessels, and the peculiar structure of its seeds, in which no appearance of radicle or cotyledons can be detected. Among the phænogamic tribe of plants, this order bears the closest affinity to *Aristolochiæ*. Its essential characters are: flowers diœcious, monœcious, or hermaphrodite; perianth adherent with the ovary, the limb in several divisions, which are imbricated in æstivation; stamens adhering in a solid central column, from the apex of which

sometimes arise horned processes; anthers adnate, either bursting longitudinally and externally, or having their inside cellular, and discharging their pollen by orifices at the apex; ovary adnate, with the tube of the perianth one or many-celled, with broad parietal placentas, which are covered with an indefinite number of minute ovules; fruit an inferior pulpy berry; seeds extremely minute.

The species belonging to this order are curious parasitical brown or colourless plants, having simple stems, which are covered with a few scales in place of leaves, and bearing flowers which grow in spikes or heads, and are sometimes solitary. They are found in the south of Europe, and also in the eastern Archipelago.

In general, the properties of the order may be said to be astringent.

The chief genera are *Cytinus* and *Rafflesia*.

Cytinus hypocistis, rape of eistus, is a fleshy pale yellowish plant, found parasitic on the roots of several species of *Cistus* in the south of Europe. The astringency of the plant is owing to the presence of gallic acid. An infusion of it is said to precipitate gelatin.

Rafflesia Arnoldi, or *Titan*, a native of Sumatra and Java, where it was first discovered in 1818, is perhaps the most extraordinary vegetable production in the world. It has neither stem nor leaves, and consists only of an enormous flower, three feet and a half in diameter, and fifteen pounds in weight, which grows as a parasite on the stem of a kind of vine. The flower consists of five petals, of a brick-red colour, and from a quarter to three quarters of an inch in thickness. In Java it is used as a powerful astringent.

A minute botanical description, and an accurate figure of the plant, are given in the thirteenth volume of the Transactions of the Linnæan Society.

CZACKIA (Andrews). An herbaceous perennial, a native of the south of Europe. It belongs to *Hexandria Monogynia*, and to the order *Asphodeleæ*. This plant was formerly known by the names of *Anthericum liliastrum*, and *Hemerocallis liliastrum*; but is now as above, *C. liliastrum*. It is a good border flower, likes a rich soil, and is propagated by dividing at the root, or by seeds.

DACRYDIUM (Solander). A New Zealand genus, belonging to the class and order *Monœcia Monadelphia*, and to the natural order *Coniferæ*. This tree is nearly allied to the genus *Cypress*, and has been, since its introduction into our greenhouses, called the New Zealand Spruce. It grows well in loam and moor earth, and may be propagated by cuttings planted in a pot of sand covered with a hand-glass. It was called *Thalamia cupressina* by Sprengel.

DACTYLIS (Linnæus), is the generic name of the common British grass, called Cocksfoot (which see).

DAFFODIL, is the ordinary name of a very common British plant, and which is one of the earliest ornaments of our cottage gardens, as well as of many of our woods and meadows. It is one of the most conspicuous species of the *Narcissus* family, and of course ranks among the *Amaryllidæ*. Many varieties of the daffodil are in cultivation, differing from each other chiefly in bulk, and in the structure of the flower. But no change has yet taken place in the original colour of the flower, it still retaining its deep yellow hue.

DAHLIA (Cavanilles). A large south American tuberous-rooted herbaeous plant, introduced *via* Spain in 1789. It belongs to the class and order *Syngenesia superflua* of the sexual system, and to the natural order *Compositæ*. This plant is now so common as to need no specific description. It is met with everywhere, in the garden of every cottage as well as of every palace, and among cultivators, in such quantities that it is truly astonishing to conceive where a vent can be had for them. No plant has been more extensively cultivated than the dahlia, and no plant has repaid the labour and care bestowed on it with more varied forms and colours than this. In form and stature it is a Proteus; in tints it is a vegetable prism. Neither is the form nor colours constant in the same individual. The first flowers will be single, and of one colour, and the last double, and of another hue; and such is the versatility of the self-colour of a parent, that its seedlings will be edged, or striped, or blotched, and altogether as unlike the mother as change of colour can make them.

The dahlia partakes very much of the nature of the potato; they are natives of the same quarter of the world, flourish with us during our summer, and, being both tuberous-rooted plants, liable to suffer from frost, require to be taken from the ground and winter-stored in the same secure manner.

There are many different plans resorted to in growing the dahlia. Every cultivator aims at having plants of diminutive stature, bearing numerous, large, and richly-coloured flowers. For this purpose, the following rules are laid down by the most successful growers: About the 20th of February, the tubers are taken out of the dry sand, or from off the shelves in and on which they have been stored for the winter, and partly buried in the bark-bed of a hothouse, or the dry soil of a mild hotbed made up for the purpose. Here they very quickly produce shoots. When these are about four inches long, slip them off, and pot them singly in proper compost, replunge them in the bed, where they may remain till the season allows of them being turned out into the borders.

The young plants can seldom be placed out of doors with safety till after the middle of May; and if, at planting time, they be tall or slender, they should be staked, to prevent injury from wind; and as they gain height and volume in the course of the summer very strong staking will be necessary.

They should not have too rich soil to grow in; dung should never be used, because this only encourages luxuriance of stems and foliage, without either expediting flowering, or causing an increase of size or beauty of the blossoms. The following compost is much used and approved of:—One-fourth mellow loam, one-fourth leaf mould, one-fourth fresh turf soil, and a like quantity of pit or river sand of pure quality and white colour.

A very extensive and successful cultivator was asked the other day whether or not the *dahlia-fancy* was nearly over? He replied, it was only beginning! for, notwithstanding the vast number of magnificent varieties now in cultivation, they would soon give way to other various tinted kinds which are every year raised from seeds. All are endeavouring to raise a *blue* variety—an object, according to Professor Decandolle, which is never likely to be seen.

DAHOON, is the specific name of a species of holly found in Carolina, and introduced into our gardens as far back as 1726.

DAISY, is the *Bellis perennis* of Linnæus, and one of our most common British pasture plants. Its humble growth, and pretty little composite flowers, are one of the principal spring ornaments of every piece of turf. There are three garden varieties of it, viz. the large double, the double quilled, and the proliferous, or hen-and-chicken daisy, all common in flower borders, and sometimes planted as edgings to them.

DALBERGIA (Roxburgh). A genus of stately trees and twining shrubs, natives of the East Indies. Linnæan class and order, *Diadelphia Decandria*, and natural order *Leguminosæ*. Generic character: calyx bell-shaped, five-toothed; keel split at the base; pod on a membranous footstalk, not opening, and containing from one to three seeds. These plants grow well in sandy loam, and are propagated by cuttings struck in sand.

DALEA (Linnæus). A genus of annual and perennial herbs, natives of central America. They belong to *Monadelphia Decandria*, and to the natural order *Leguminosæ*. This genus is allied to *Psoralea* and *Galega*. Several species of it are kept in our greenhouses, and propagated by cuttings, but which, if exposed to much humidity, are liable to drop off.

DALECHAMPIA (Linnæus). A climbing tropical genus of plants, natives of Brazil, belonging to *Diacia Diandria*, and natural order *Euphorbiaceæ*. These are seen in stove collections, and are grown in loam and moor-earth, and are easily propagated by cuttings.

DAMMARA (Rumphius). A genus of lofty-growing forest trees, of the *Pinus* family, found at Amboyna and in New Zealand. This was called *Pinus dammara* by Lambert, *Agathis loranthifolia* by Salisbury, but now a separate genus as above. Rooted plants grow freely in sandy loam and moor-earth, but are very difficult to strike from cuttings.

DAMPIERA (Robert Brown). A New Holland genus named in honour of Captain W. Dampier, a celebrated navigator and botanist. It belongs to *Pentandria Monogynia*, and to the natural order *Goodenoviæ*. It is easily propagated by cuttings.

DANDELION, is the *Leontodon taraxacum* of botanists, and one of our most common and conspicuous British weeds. It annoys both the farmer on his arable land, and the gardener among his crops; to the latter it is a disgrace, if suffered to flower. Nature has done much for this plant, even the smallest portion of its root, forms a new plant, and its seeds, being furnished with a most elegant flying appendage, are transported far and wide by the wind. On the continent, the leaves, when blanched, are preferred to endive; and it is said that, when the roots are oven-dried and ground to powder, they are no bad substitute for coffee. Goats, sheep, hares, and rabbits, are fond of the leaves; but it is by no means a desirable plant either in meadows or pastures.

DAPHNE (Linnæus). A rather extensive genus of highly ornamental shrubs, natives of many different countries, though chiefly European. Linnæan class and order *Octandria Monogynia*, and natural order *Thymeleæ*. Generic character: calyx corolla-like, funnel-shaped, withering without dropping off, four-lobed; stamens inserted in a double series on the tube; anthers roundish; style very short; stigma headed; drupe many-seeded. There are above twenty species of the genus, and many varieties, some of them exceedingly ornamental. Some are stove, others greenhouse, and the greater number hardy. A few

are propagated by layers and cuttings, but most are increased by grafting on the common wood-laurel (*D. laureola*), or on the mezereum. Some of the smaller sorts grow well in moor-earthly soil, prepared for American plants, but most of them thrive in any light soil.

DAPHNIA (Müller; MONOCULUS, Linnæus). A genus of small crustaceous animals belonging to the sub-class *Entomostraca*, order *Branchiopoda*, and section *Lophyropoda*. The body is of an oblong oval, and compressed form, evidently enclosed in a bivalve shell, attached to the skin, having its aperture beneath the body, and its hinge above the back. The head is distinct, and produced beneath into a kind of snout, furnished with a single central small eye. From each side of the head arises a large antenna-like organ, having a long basal joint, at the extremity of which each antenna is divided into two long articulated branches, each of which supports a number of long bristles. The functions of these organs in swimming, being, in fact, the only external apparatus employed in this motion, has induced M. Straus to regard them as forelegs, although it is evident, as Müller and Jurine observed, that they represent the upper antennæ of the typical crabs. And here we may take occasion to notice the great difficulty existing in the determination of the nomenclature of these and other organs, in groups of animals which recede so entirely from those which, by common consent, are considered as the types or normal divisions of the class—and, indeed, the remark is applicable in every other branch of the creation. We mention this subject because Dr. Johnston, the celebrated naturalist of Berwick-upon-Tweed, has recently published some observations bearing upon this view of the question in the Magazine of Natural History, which deserve attention.—Speaking of one of the species of the shark parasite, *Pandarus alatus*, he says: “The student who is anxious to see how ingeniously the few and simple organs of this creature can be analysed and resolved into parts corresponding with the complex organs of the crab and lobster, must consult the interesting memoir of Milne Edwards (in the Dictionnaire des Sciences Naturelles, vol. 28). I must acknowledge that the analogies seem not a little imaginary, and the nomenclature derived from them is at least faulty, in so far that it gives, or is apt to give erroneous ideas relative to function; the feet-jaws are not subservient to mastication in any way; the animal is suctorial, and requires no jaws, and these organs are used solely to obtain fixedness of place, while the thoracic feet again are not organs to walk or creep on, but are only calculated for swimming, which, we can conceive, it may often have occasion to do.” Although we admit to its full extent the soundness of Dr. Johnston’s remarks, in examining an animal *per se*; we certainly do feel, when investigating the same animal with reference to the structure of the remainder of its class, that the great difficulty with which the subject is surrounded ought to make us hesitate before we condemn a series of names which the strictest analogy has proved to be correct. Let us, however, look at the matter with reference to some of the better known examples of the class. Examine a lobster and a crab, and the mouth is found to be externally composed of several pairs of flattened organs, having a transverse motion, and evidently acting as jaws, whilst the large pair of fore legs is terminated by great and powerful claws. Now, examine a spiny lobster (which is not uncom-

monly to be met with in the fishmonger’s shop, belonging to the genus *Palinurus*), and the claws are no longer to be seen; in their stead a pair of limbs are found, having indeed the same number of joints as claw-legs, but formed like the following legs, and evidently being employed in locomotion. But will it be said that the least stretch is given to our fancy when we assert that the leg of the *Palinurus* is the claw of the lobster in a modified state of development, or that the former analogically represents the latter? Should we incur the chance of ridicule if we describe the claw of the lobster as a leg, although it be employed only in prehension, and not in locomotion?—Let us, however, now examine one of the little leaping shrimps, so common on the sea coast, and of which one species abounds in fresh water (*Gammarus pulex*), and we find the mouth deficient in a certain number of pairs of organs, but that the legs have obtained an increase of the same number of pairs; whilst the examination of such genera as *Sergestes*, *Sicyonia*, &c., clearly demonstrate the transition of structure and function from mouth organs to legs. Will it be said that we are adopting a faulty nomenclature, because we employ a term for these thus transitory organs, which indicates that they are liable to this singular kind of transition? We are aware that, by the unthinking, and by those who would lead the unthinking by the employment of arguments resting upon general and, as we may say, vulgar observation, rather than upon accurate but difficult analysis, we should be ridiculed in asserting that the sucker of the butterfly, and the under-jaws of a beetle, are the same organs in a different state of development, and in applying to both the same term; but we contend that the arguments which we have above brought forward are applicable to one case as well as the other; that there is no fanciful theory to be built upon this strict application of the rules of analysis and its consequent analogy, and that when, by the application of the former, and the adoption of the latter, we arrive with certainty (and here, as we said in the outset, lies the great difficulty) at the conclusion that a certain organ in one animal is the representative of an organ in another animal, we are at liberty in a strictly philosophic view of the subject to apply to both the same name, although in common parlance it is necessary, perhaps, to use different terms indicating the precise functions of each organ.

Within the shell of the *Daphnia* are to be observed ten small leg-like organs, having the second joint vesicular, the eight anterior ones being terminated by a dilated joint, margined with hairs, and serving as oars, the anterior pair appears, however, to be employed more especially in prehension; the posterior pair of legs is differently constructed. By a curious provision the eggs are deposited in a dorsal kind of pouch beneath the shell within which they are hatched; at the end of the fifth day the young have acquired sufficient power to take care of themselves, and are expelled by the female.

These animals, of which there are numerous species, are found in fresh and standing water, where they swim about with very great agility, their large branching antennæ giving them a curious appearance, hence they form interesting objects for the microscope.—Their history has been traced, notwithstanding their minute size, by several eminent observers, the works of Messrs. Schaeffer, Ramdohr, Straus, and the elder Jurine may be especially mentioned. By Swammer-

dam, also, they were noticed under the name of *Pulex aquaticus arborescens*, the latter name being given to them in allusion to their branching antennæ. It has been observed as a remarkable circumstance, of which but few instances occur in nature, that a single impregnation is sufficient for several (six or more) generations. An analogous law occurs amongst the plant lice (APHIDES, which see). Occasionally these insects abound in stagnant water to such a degree as to impart to it their own tint; and as one of the species is of a red colour, the colour thus imparted to the water has been supposed to have been caused by blood.

The type of the genus is the species above mentioned, or the *Monoculus pulex* (Linnæus). It is about one-twelfth of an inch long, and in spring is of a red colour, which towards the summer becomes rosy; but at other seasons it becomes of a greenish white colour. It is very abundant.

DARNEL, is the *Lolium temulentum* of Linnæus, a species of grass too often found in autumn-sowed crops of corn. If its seeds, which are nearly as large as those of rye, are mixed with wheat, and made into flour therewith, it renders the bread bitter and unwholesome. Indeed, the plant is the dread of farmers, and the seeds are detested by the miller; nor is there any easy way of ridding the wheat of it, if thrashed together. Hand-picking the sheaves, as they pass through the hands of the binder and thrasher, is most effectual, because neither sieve, nor skreen nor fanners, can separate the darnel from the wheat; and if a single grain of the former be seen in the sack at market, the value of the latter is very much reduced.

There are two old popular errors relative to this plant which are not entirely discredited at this day. The first is, that it is the plant whence the cultivated wheat was originally obtained, and that wheat may be grown till it all turns again to darnel! This is truly ridiculous; for, except being in the same natural order, no two plants can be more unlike in quality than the *Lolium temulentum* and the *Triticum hybernum*, or common wheat.

It is said to be sometimes used in the manufacture of low wines, for the purposes of the compounder of strong liquors; but this requires confirmation, as it is so strongly poisonous.

There is another grass which is sometimes confounded with darnel, because it is sown and reaped, and appears in the sample along with true darnel. This is the *Bromus secalinum*, a plant yielding seeds little inferior to small oats, and of fully as good quality. This last is called *ray*, and the other is called by its right name, *darnel*, though they are often mistaken for each other. The one is sweet and wholesome, the other bitter and stupifying.

DARTER—Anhinga.—A genus of web-footed birds belonging to the pelican family, and in many of their appearances and habits nearly allied to the cormorants. The species are not very well made out; but as the nearly allied genus of the cormorants is subject to considerable varieties of colour, both with age and with season, it is probable that the birds which have been noticed as differing a little from each other are all of the same species.

The species which is best known, if not the only species, is the white billed anhinga (*Plotus melanogaster*), which is found in the humid parts by the rivers, pools, and lagunes near the shores in the southern part of the United States, in Brazil, and

other parts of South America; and also on the humid parts of the west coast of Africa to the south of the desert.



Darter.

The length is about two feet ten inches; the wings long; the tail very long, the head and neck slender, the bill long and perfectly straight; the mandibles enlarged at the base, tapering to points at the tip, and finely serrated in the tomia; the upper mandible slightly channelled on each side; the nostrils linear in the channels, and concealed by a membrane; the tarsi short, but very thick and strong; all the toes webbed, the web of the hind toe joining the inner one as in the cormorant and all the birds which dash into the water for fish; the toes armed with crooked claws. The head is smooth, the colour of the belly white, all the other parts raven black, except a few mantlings of white on the tail.

It reposes on trees, where it also nestles, finds its food in the waters, and is rarely seen on the ground. When in a state of repose, the long neck is folded back upon the shoulders, and the bird stands upon the top of the tree rather than perches. Its perch or nest is seldom far from the water; and when the weather is very sultry, it may be often seen standing on a branch which projects over the water, and expanding and moving its wings and tail, as if producing a current of air to cool it. On these occasions it is said to contemplate its own image in the stream, but that wants confirmation, though many birds are known to be much interested with looking-glasses. If disturbed while thus fanning itself, it drops head foremost into the water as if shot, or rather struck by lightning, and instantly disappears, producing very little rippling, as its pointed bill, slender head and neck, and finely tapered shoulders, divide the water with the greatest ease. After a little time it ascends and shoots out of the water like an arrow at a considerable distance from the place at which it dived. At other times they fly high over the waters, and with powerful wing, darting down occasionally and capturing fish, which they do with great rapidity and certainty.

They are social birds, always found in packs, and sometimes in pretty numerous flocks; and though they are thus numerous in the same locality, they are generally fat, as they resort only to those places where they find plenty of food. They frequent only the perennial waters; they do not need to fatigue themselves by migrating from place to place. Their nests are rudely formed of sticks in the tops of the

trees, in a manner resembling those of the cormorants; but as the places in which they build (often in the mangroves) are not very accessible on account of their swampiness, and as they are besides not a little pestilent, the family habits of the birds are not very well known. They are birds, however, which form a feature of the peculiar localities which they inhabit. They are not much disturbed, as their flesh is rank and bad.

DARWINIA (Rudge). A genus of two ornamental shrubs from New Holland. Linnæan class and order *Decandria Monogynia*, and natural order *Rhamneæ*. Generic character:—calyx like a tubular corolla, limb five cleft; corolla none; stamens very short, in a double series on the throat of the calyx; anthers oblong; style long and protruding. Easily propagated by cuttings.

DASYCHIRA (Hübner). A genus of lepidopterous insects, belonging to the family of Moths, *Arctiidae*, having the wings rather long, and the palpi very short and hairy. The spiral tongue is obliterated, and the fore legs very hairy; the caterpillars are very hairy, being furnished with pale tufts of hairs, which render them very conspicuous, and from which they have obtained the name of tussocks; the cocoon is of a close texture, having the hairs of which these tufts are composed worked into its meshes. There are two British species, the dark tussock (*Bombyx fascelina*, Linnæus), about two inches in expanse; and the pale tussock (*B. pudibunda*, Linnæus), a common species in the neighbourhood of London, rather larger than the preceding, having the wings of a whitish ash colour, the anterior pair having a central lunate spot, and three waved streaks of a brown colour. In Kent, the caterpillars are found in the hop gardens, and are called hop dogs.

DASYPODA (Latreille). A genus of hymenopterous insects, belonging to the section *Mellifera*, and family *Andrenidæ*, or short-tongued bees. The species are of moderate size; the hind legs, especially in the females, are, as the generic name implies, very hairy, the basal joint of the tarsi being very long, and furnished with a complete brush of hairs; the wings have two complete sub-marginal cells; and the tongue is lance-shaped, and folded back upon the upper surface of the horny mentum. There is only one British species of this genus, and which was dedicated to Swammerdam by Mr. Kirby, in his History of the English Bees, in which work we find the following account of the habits of this pretty and interesting species:—"No person, at first sight, would take the male and the female of *M. Swammerdamella* for the same species, so widely do they differ in most particulars; nor should I have suspected that there was any connection between them, had I not discovered their retreat. In the month of August, 1797, I saw a female take her flight from a grassy declivity of a southern aspect, which was much entangled with roots and shrubs. Upon examining this spot more narrowly, I discovered a number of small burrows, each of which had a little heap of sand, which had been excavated from it, lying before it. In some of these burrows I saw our melitta (*Swammerdamella*) sitting, with her head at the mouth, enjoying the sunshine. At the same time I observed many other insects flying about the spot. Upon my attempting to take them, they disappeared, but they soon returned to their amusement. With some difficulty I at length succeeded in taking one,

and it proved to be the male."—Vol. i. p. 176. The body is of a black colour, clothed with pale fulvous or ochreous hairs, the abdomen of the female with three whitish belts, and the hind legs with orange hairs. It is rather a rare species, although occasionally met with in certain localities in some quantities. The food of the larvæ consists of pollen paste, stored up in cells by the female, which prefers the pollen of such flowers, as *Crepis*, *Hæracium* and *Leontodon*.

DASYPOGON (Meigen). A genus of dipterous insects, belonging to the section *Tanystoma* and family *Asilidæ*. The body is long and thickened, often woolly; the antennæ are shorter than the head, with the terminal style distinct and conical, not terminated by a bristle, and the proboscis is straight.

This is an extensive exotic and European genus, forty-four European species having been described by Meigen; two only have, however, been found in this country; namely, *D. punctatus* (Fabricius), which is exceedingly rare; and *D. brevirostris*, forming the type of Mr. Stephens' genus *Leptarthrus*, established upon the very slender form of the posterior tarsi in the males. This species is of a black colour, with the four posterior tibiæ red at the base. We have met with it in the beginning of July, in some abundance, amongst grass, in the Devil's Ditch, on Newmarket Heath.

DASYTES (Paykull). A genus of coleopterous insects belonging to the section *Pentamera*, subsection *Serricornes*, and family *Melyridæ*, having the antennæ as long as the head and thorax, the body narrow and sometimes linear, the claws of the tarsi generally furnished with a membranous appendage, palpi filiform, and body destitute of the vesicular lobes visible in the *Malachii*. The name of the genus is of Greek extraction, and is given to these insects in consequence of the numerous hairs with which they are clothed. But little is known of the early history of these insects, which, in the perfect state, are generally found upon grass and umbelliferous flowers, in hedges, trees, &c. The species are numerous, and often prettily variegated in their colours; the indigenous species are of small size. Dejean, in his new Catalogue, gives seventy-four species, the majority of which are European and Brazilian. Stephens gives eight British species, of which the *D. cæruleus* of Fabricius is one of the prettiest, being of a bright blue colour. It is about a quarter of an inch long, and is found on the southern coast. Some of the other species present various curious peculiarities of structure, such as the legs spined and twisted, the body quite linear, &c.

DASYURUS (rough and hairy tail) a genus of marsupial mammalia, peculiar to Australia, and in some of the species peculiar to the larger island, New Holland, and in others to Van Diemen's Land. It is worthy of inquiry what geological epoch of a country requires the presence of the marsupial or pouched mammalia in it; but the reasonable conjecture, from the fact of at least one marsupial animal being found in a fossil state in Europe, while within the period of history there has not been a living one found native nearer than America, would lead to the supposition that they are adapted for rather an early age, as respects the formation of the peculiar locality, if, according to what appears to be the most rational theory on the subject, we are to suppose that countries like their productions have a beginning, a duration, and an end; and that as they in all probability outlive races of animals, just as races outlive genera—

tions, the earth will be able to produce country after country, for a succession of changes, of the term of whose performance we can frame no conjecture, before the powers of the globe become unfit for the production of another new land; and so the ages of its duration are at last numbered, and it is by some great power, which is still an instrument in the hands of its maker, scattered in viewless atoms through the regions of space. This is a subject of great interest as well as curiosity, to which we shall briefly revert in the article *Marsupiatæ*, and more at large in the general article *Mammalia*, so that we must in the mean time confine ourselves to a very short notice of the genus, of which the systematic name stands at the head of this article.

The animals of this genus, some of which are however but imperfectly known, are almost, if not altogether, the only carnivorous mammalia of the extensive countries in which alone they are found; for there is little doubt that the *dingo*, or wild dog, (which, however, may be said to be in a state of domestication, bearing the same relation to the domestication of the dog in Europe, as the state of the native of Australia bears to European civilisation), the dingo is, probably, nay certainly, an importation by the Malays, which have long resorted to the north-eastern parts of New Holland to fish for *trepang* (*Holothuria*), for the supply of the Chinese market.

It is a remarkable fact that the carnivorous animals of Australia should be more so than the marsupial animals of other countries, while animals that are wholly herbivorous are also in the same country furnished with similar appendages. But though the fact is striking, we are not in the present state of our knowledge able to deduce from it any conclusion which enables us to connect any thing in the physical geography of Australia, which peculiarly adapts it to the habits of those pouched animals. We cannot let slip this first opportunity which has occurred in the order of alphabetical arrangement of noticing these singular animals, which unite indications of a physiological nature more than any other class of animals, without mentioning how desirable it would be to pay somewhat more attention than is usually paid to those circumstances, of a nature bearing upon both (of course) which link peculiar animals to their peculiar localities. In many instances, there is no doubt that the abundance of its most favourite food which the locality affords, has a very considerable influence in determining the animal towards that locality; but this can hold true only in the case of migrant animals, and will not apply to such genera as that under consideration, which have no means of crossing the sea by which their country is surrounded. The genus *Dasyurus* must be a native of Australia; and what is more, as there are some which are met with in the smaller island only, and some only in the greater, and as the differences between these are of too decided a character for our admitting the possibility of the one being a climatal variety of the other; and, further, as there has been no artificial training calculated in the least to change either one or other of them, the question becomes one of still greater interest to every one who would wish to obtain a solution of the most interesting problem in the whole range of national history—why animals should, in their physiological structure, differ from each other?—why should almost the whole of the native mammalia of Australia bring forward their young by a double gestation, the one in

an internal uterus, and the other in an abdominal pouch, while in Southern Africa, the latitude of which is the same and the climate not very dissimilar, there is not a single animal having even a fundamental vestige of this double gestation.

The genus *Dasyurus* has been, by various naturalists, divided into several genera; but as there are very strong resemblances between them all, we shall include our brief notices of them all in one article. Indeed, there is a characteristic physiognomy which runs through the whole of the marsupial animals, whatever may be the character of their food, their habits, their size, and even the forms of their bodies, which shows them to be a race actually belonging to a different system, and apparently a different epoch, from the common placental mammalia, of one internal gestation. Whether their fur be rough or smooth, it does not appear of the same texture as that of our mammalia; and there is, generally speaking, a ruggedness in their appearance, and a want of speculation in their expression, which makes them look as if they were not at home in the present period of the world's history, and did not form an appropriate part of its economy.

Their generic characters are: six grinders or cheek teeth in each jaw, of which the two anterior ones are compressed and trenchant, and the remaining four tuberculous, resembling those of insectivorous mammalia; their incisive teeth are small in size, eight in the upper jaw, and six in the under; and they are furnished with four canines; but the teeth altogether have a ragged appearance compared with those of the placental carnivora, and at the same time there is an apparent want of vigour in the jaws. They have on all the feet five toes, which are long, and very distinct in their phalanges, and armed with crooked claws, with the exception of the thumbs on the hind feet, which are little else than rudimental, and without any claws. The last phalange of the hind toes is furnished with a tuft of long hair, which extends forwards, and covers the claws. Sexually, the male agree with the opossums in the bifurcation of the organ, and in some other particulars, and there is that air of correspondence which we have remarked, as being characteristic of all the marsupiatæ; but they are without the climbing feet of the opossums, which, from the reversed thumb, are enabled to take hold of branches much in the same manner as the ai-ai. The ears are rather short and covered with hair; the tail is long and hairy, generally thick at its insertion, and in some of the species it is compressed laterally; but it is not prehensile in any of the species, neither are any of them capable of climbing for their food. They live much in concealment, and resemble in their habits the fox and the polecat, more than they do any other of the mammalia of Europe. They are all ravenous in proportion to their size; but their food varies considerably. The structure of their cheek teeth shows that they all can subsist upon insects; and it is probable that these constitute the principal food of the smaller ones. But those which are of more formidable size prey upon the smaller kangaroos, the ornithorhynchus, and bats, which are very numerous in some parts of the country. They also prey along the shores, eating indiscriminately mollusca, fish, and any carrion or garbage however putrid. They are also said to plunder the poultry yards of the colonists in waste places, and also to destroy lambs. Their dispositions are bad, but even the largest of them have not courage in pro-

portion to their strength, and it is doubtful if they ever incline to attack the large kangaroo, or even the emu, unless they can come upon it by stealth; the colonists have given them the names of those European and other animals to which they fancied they had the greatest resemblance, such as cats, wolves, hyænas, leopards, and other names; but there does not appear to be a single native animal, or any one of those genera, in the whole of Australia.

There are at least eight species of the genus, three of which are natives of Van Diemen's Land, and the other five of New Holland; but it is probable that as the latter country becomes better known, more species may be discovered.

Dasyurus cynocephalus. This species is of Van Diemen's Land, and it differs so much from the others in some of its characters, that it has been made a separate genus under the name of *Thylacinus*. It is an animal of considerable size, being about three feet and a half in length, exclusive of the tail, which measures about two feet. It stands one foot one at the shoulder, and one foot eleven at the rump,—the marsupial animals being almost, without exception, higher and more stoutly made in their hinder parts than forwards, which forms a very distinguishing character between them and the generality of animals which are not marsupial.

The tail of this species is very peculiar, and different from that of all the others of the genus, being compressed or flattened sideways. The covering of the animal is smooth and short, of a dull yellowish brown in the ground colour, paler on the under part, and mixed with grey on the back; and across the loins and rump there are six or seven transverse bands of black, two of which extend down the thighs. This animal squats on its hams in the attitude of a dog, but its expression is dull and stupid, and it has neither the sagacity nor the activity of the predatory animals of Europe. It is generally found near the shores, and lodges in deep caverns and clefts of the rocks, so that it is not often seen in proportion to its numbers.

Dasyurus ursinus. This is also a native of Van Diemen's Land, and not found, so far as is known, in the larger island. It is smaller than the former species, and different in all its characters and habits, so that the generic distinctions between them appear to be correct; and it is probable that, when they come to be better understood, it may be necessary to subdivide them into more than two genera, though they will still require to be kept together as a very natural group.

The present species is about two feet and a half long, and the tail about nine inches, and unlike that of the last species, it is naked on the under side, and slightly prehensile. The whole body and upper part of the tail are covered with shaggy black hair, marked on the back with a few obscure white blotches. It is in consequence of this rough covering that it gets the name of the bear; and its peculiarly repulsive aspect has procured it from the woodsmen of Van Diemen's Land, who are not over chary in their vocabulary, the name of "the Devil." Its manners, like those of most of the genus, are very little known: it lives in obscurity, and though, from the character of its teeth, which are the same as those of the former, it in all probability feeds a good deal upon insects, reptiles, and its fellow-lodgers the bats, yet it is said to range more extensively, to be more fierce and daring, and to commit greater depredations upon poultry and lambs than

the former one; still, however, when seen, for that is not often, as it is in the depths of caves during the day, it is near the shore, and very generally close by the margin of the waters.

It is worthy of a passing remark, as throwing some light upon the natural state of Australia, and this is a subject to which much attention should be paid, because we are in possession of its history, clearly and fully from the very first time that a sod of it was broken by the spade, that both the human inhabitants and the predatory animals of this part of the world were found only on the margin of the waters, chiefly on the sea-shore, but also, at least seasonally, on the banks of the rivers, and that the chief subsistence of both was fish, and at some seasons of the year shelled mollusca. This may, perhaps, account for the very small number of even these species of predatory animals in regions so extensive, and also for the extirpation of them from the larger island, supposing them once to have been found there, at least it is a remarkable instance of man and the predatory animals being rivals for the very same food in the very same localities; and we may naturally suppose that rude as were the aborigines of these countries they would exert themselves to extirpate the dasyuri with the same assiduity that the wolf and the fox have been hunted down in Europe, and the former extirpated in many parts of it. The wars of wild men against wild animals, would not only be an exceedingly curious subject in itself, but if it were properly studied it would throw considerable light upon the progressive history, at least, of the predatory part of the animal kingdom.

Dasyurus minimus. This is also described as a native of Van Diemen's Land, and has been much more readily met with than either of the other two. It is a very small animal, not above four inches in length, and the tail short, with very short hair, the fur on the body is soft to the touch, and reddish at the points. Its head is conical, and its muzzle very small. Altogether it has fully as much resemblance to the opossum as to the other members of this group. Very little, however, is known of its history.

Dasyurus macrourus. This species is found in New Holland, and was for some time described as belonging to the weasel family, and named as such by Shaw who was long employed in the naming of beasts, though sometimes not very happily; but then the fault was not his, as he had only the skin to name them from, and of course had no means of judging of their structure, or assigning them a place in the system, in accordance with their nature. This species is styled the spotted marten, and sometimes the wild cat by the colonists, which has led those who make up works from popular sayings, without having the means of ascertaining their truth, to include the cat among the native animals of Australia, though there is no reason to believe that there is a single individual of the feline group indigenous to the country.

This species is about a foot and a half long, with a tail nearly the same length. Its fur is very thick, and soft to the touch, the colour otter brown, relieved with spots of pure white, which are very small on the back, but yet larger on the sides, and the belly is entirely white. The head is maroon red, and the feet yellowish. The two incisive teeth in the middle are more produced than the others, which gives the mouth of the animal a ragged appearance. This is a nocturnal animal.

There is some obscurity about the distinctions of the other species, as it is doubtful whether some of them which have been described from single specimens may not be the young of the one under consideration. The investigation of those disputed points could have little interest for the general reader, and therefore we must refer such as are anxious to be better acquainted with the carnivorous mammalia of Australia, to the systematic works; and, from the zeal and ability of many of those who are now investigating the natural history of the colony in all its departments, we have no doubt that information will soon be obtained which will be highly satisfactory; and, therefore, it would be ill-judged on our part to hazard conjecture while in expectation of the truth.

DATE PALM is the *Phoenix dactylifera* of Linnæus. This is one of the most useful of the palms, it yielding every year great crops of fine rich fruit, forming not only a valuable part of the food of the lower orders of society, but a vast surplus for exportation to other countries.

Persia, Palestine, and the northern states of Africa appear to be the most congenial climates for the successful culture and growth of the date tree. In some of those countries there are extensive groves of them, furnishing employment and wealth to the generally indolent natives. The stem is not so lofty as some of the other palms, but it is comparatively much thicker and very rugged from the persisting bases of the fallen fronds. When the fruit are ripe, they are shaken from the pendent spadix by one man, while others hold a cloth, extended below, to receive the falling fruit. These are afterwards sorted and prepared for packing in jars or boxes for sale.

Young date trees may be raised from the stones of the imported fruit; and as they have much divided and persisting foliage, they add an interesting variety to the stove collection. If planted in a tropical conservatory, and allowed time and space, there is no doubt but they would flower and fruit in this country, which would, at least, be a great curiosity to British botanists.

DATISCEÆ. A natural order of dicotyledonous plants containing only a few genera and species. In its habit and the structure of its fruit, it bears a close resemblance to *Acsedaceæ*, and seems to be a connecting link between that order and *Urticeæ*. Its essential characters are: flowers diœcious; perianth of the male flowers divided into several pieces, that of the females free, toothed; stamens several; anthers two-celled, membranous, linear, bursting longitudinally; ovary one-celled, with polyspermous parietal placentas; stigmas equal in number to the placentas, recurved; fruit capsular, opening at the top, one-celled, with polyspermous parietal placentas; seeds enveloped in a membranous, finely reticulated integument; embryo straight, without albumen, its radicle turned towards the hilum.

The plants belonging to this order are strong hardy herbs, with alternate compound leaves without stipules, and axillary racemose flowers. From their resemblance to hemp, some of them receive the name of bastard hemp.

They are found in the northern parts of America and Asia, as well as in the Indian Archipelago, and the southern countries of Europe.

Their properties, so far as known, are bitter and tonic.

The chief genera are *Datisca* and *Tetrameles*.

DATURA (Linnæus). A genus of herbaceous annuals, natives of many foreign countries, one of which the *D. stramonium* has become naturalised and grows wild in England. They generally bear large white or purple flowers, but are of a short duration. They belong to the fifth class of Linnæus, and to the natural order *Solanææ*. Seeds.

DAUBENTONIA (Decandolle). South American evergreen shrubs, belonging to *Diadelphia Decandria*, and natural order *Leguminosæ*. Generic character:—calyx bell-shaped, five-toothed; keel obtuse; pod on a footstalk; linear, with four longitudinal wings; pod contracted between the seeds. This genus has been consecutively called *Piscidia*, *Robinia*, *Aschynomene*, till settled by Decandolle as above. These plants thrive in loam and moor-earth, and are easily propagated by cuttings in the usual manner.

DAUCUS (Linnæus). Is the generic name given to the family to which the common carrot belongs. The genus ranks in the fifth class and second order of the sexual system, and in the natural order *Umbelliferæ*. Some few are annuals, but they are mostly biennials: of all our cultivated culinary vegetables, no one shows the effects of domestication more decidedly than the carrot. It is found wild on every dry hedge-bank, every where in Britain, as well as on the continent. In its wild state, it is a diminutive plant, with an underground stem, no bigger than a small radish. In former times the daucus was held in high estimation as a medicine; a decoction of it being considered useful as a diuretic, or solvent of the human calculus. It might be at first introduced into the garden of the herbalist for its medical properties only, and there showing a tendency to increase in bulk, might be in the course of time removed from the simpler's shop to the green larder of the cook.

The improvement of the plant in bulk must have been gradually accomplished. It is unreasonable to suppose that a wild plant would suddenly, in any season or in any place, swell from a mere stick to a portly tuber at once.

How or when it became a culinary plant is, perhaps, not now known; but looking at the wild one on its native bank, and on the full-grown Altringham variety on the green grocer's stall, we are compelled to acknowledge that there is not a stronger proof of the ameliorating effects of culture exemplified in the whole range of vegetation.

And it is not only an improved bulk of the common wild plant that has been the only result of skill and industry, many varieties have been originated by attentive cultivators; so that there are large and late sorts for feeding cattle, and small, early, and more delicately flavoured sorts for the table; in all fifteen varieties, differing in size, colour, shape, or earliness.

Cultivation. As carrots may be used at any stage of their growth, and as they are most tender when young, seed is sown at many different seasons. The first sowing may be made about the twentieth of February; but this sowing should occupy only one or two narrow beds on a dry, finely-digged, south border. Here the seedlings may be forwarded and protected from the keen winds of March by a thin covering of dry fern leaves or pea-straw; and in order that such covering may not harbour slugs, snails, and worms, it should be from time to time dusted with hot lime, which will save the seedlings from destruction. Carrots are also sowed about the same time on

slight hotbeds and under glazed frames, to get them ready for table as early in the year as possible.

The principal crop of carrots either in the garden or fields may be sowed any time between the twentieth day of March and the tenth of April; and successive sowings should be made in every month till September. This is, however, only necessary where young carrots are constantly required in every month of the year.

The seed requires to be prepared for sowing by being well rubbed between the hands until divested of the fringe of little hooks with which they are invested when gathered; otherwise they cling to each other so closely, that they cannot be equally distributed by the sower. When prepared, the seeds may be sowed either in shallow drills one foot apart, or broad-cast on beds three and a half feet wide with alleys between. Whichever way the seeds are sown the plants will require to be thinned to eight-inch distances apart either by hand or hoe. This thinning is usually performed in dry weather, and when the plants are two or three inches high. When this is done the crop only requires to be kept free from weeds during summer, and until fit to be taken up for storing.

Carrots are usually taken from the ground about the end of October. A dry day is most suitable, because the tubers are easier freed from the earth; and being sorted and topped, and quite dry, are then stored in sand in a dry shed or hovel for winter and spring use.

Carrots thrive best in deep sandy loam, and are larger or smaller, according as this is rich or poor. Their form indicates that a deep loose soil is requisite; and, therefore, deep digging or trenching the ground intended for carrots is indispensably necessary. It is not customary to dung for this crop; because if not trenched in very deep, the tubers are liable to be deformed, becoming forked rather than straight. The roots are liable to be disfigured by the larva of an insect which eats into the rind; this defect occurs mostly in old garden ground; and more especially to the crops sowed in March. If sowed on fresh loamy land they suffer less from the worm; and the sowings made in April and May are not eaten so much as the early crops.

The garden varieties of carrot are as follow:—

Early Horn,	Long Orange,	Fine Surrey,
Scarlet Horn,	Short Orange,	Altringham.

There are also three or four other varieties named from places where they are most successfully cultivated. But the early horn is always chosen for the first crops, whether on hot beds, or in the open ground, and also for the last sowings in August and September; and which latter, if they gain any useable size, require covering from frost. For principal crops in gardens or fields, the long orange and Altringham are preferred, because of their larger growth and fitness for farming purposes.

Some cottagers, and even professional gardeners who are situate on stiff-clayed soils, are obliged to have recourse to a peculiar mode of culture, in order to procure large and handsome carrots. On the ground intended for them, ranks of holes are made by line with an iron-shod taper dibber, fifteen inches in length; the holes are filled with fine rich compost, and on the surface of each two or three seeds are dropped and slightly covered. When the plants have risen out of harin's way, one only is left in each

hole to grow to perfection. The leading radicle finds a free course downwards, and the whole root necessarily receives a fine form, and arrives at considerable magnitude.

DAVIESIA (Smith). A genus of New Holland evergreen shrubs, Linnæan class and order *Decandria Monogynia*, and natural order *Leguminosæ*. Generic character: calyx bracteate, bell-turbinate, five-toothed. Corolla, vexillum inversely-heart-shaped, erectly reflexed. Keel having short wings. Style straight and persisting. Pod compressed, one-seeded, lower suture dilated, and somewhat trapezium-shaped. These pretty plants thrive well in our green-houses potted in loam and moor-earth, and are propagated by cuttings struck in sand under a hand-glass and without bottom heat.

DAY LILY. Is the genus *Hemerocallis* of Linnæus and other botanists. They (the four species) are hardy, herbaceous plants of rank growth, and suitable for borders of shrubberies, and among plants of tall growth.

DEADLY CARROT. Is the *Thapsia villosa* of Linnæus, an umbelliferous genus, found in the south of Europe, two species of which are considered highly poisonous.

DEADLY NIGHTSHADE. Is the *Atropa Belladonna* of Linnæus. It belongs to *Pentandria Monogynia*, and to the natural order *Solanææ*. It is a strong growing plant, with large ovate leaves, purple bell-shaped flowers, succeeded by dark-red coloured berries, as large as small cherries. The plant is often found growing in rubbish of old buildings, and on waste ground about farm-houses.

DEAD NETTLE. Is the *Galeobdolon luteum* of Smith, a common British plant found in moist, shady places: it receives its name from its resemblance to a nettle, but without its stinging property.

DEATH'S-HEAD MOTH. The largest species of lepidopterous insects found in England, and systematically known by the name of *Acherontia atropos*. By Linnæus, indeed, it was placed in the genus *Sphinx*, but as it differs in several material points from the majority of the insects of which that genus is composed, Ochsenheimer, a German lepidopterist, separated it under the generic, or rather, perhaps, subgeneric name of *Acherontia*. The specific name *Atropos* (the third of the fates in the heathen mythology, who was supposed to cut the thread of life,) is given to it in reference to the very peculiar markings upon the back of the thorax, which, as the English name indicates, very closely resembles a skull or death's-head. And here we may be allowed to notice the admirable plan introduced by Linnæus of giving to each distinct species of animal, a name, consisting of a single word, whereby in general, some peculiarity of the creature is indicated. Before the introduction of this system it was necessary, in mentioning any animal, to give a short description of it, as for instance, of the insect in question, it would have been necessary to speak of the "*Acherontia atropos*" as "a large moth having a skull marked upon the back." Whereas by the concise and elegant terms invented by Linnæus, all this circumlocution is avoided, and by the employment of a generic and a single specific word, the animal is known through the whole of the scientific world.

The Death's-head moth measures from four to five inches in expanse, the fore wings are of a dark brown colour, variegated with grey, brown, and black, with a white central spot; the hind wings are clay-coloured

with two dentate black fascia ; the abdomen, which is very robust, is also clay-coloured with black bands, and a black central dorsal line. The thorax is blackish grey, with a large central, pale, irregular



Death's-head Moth.

patch, in which are two round black spots. "This grand species," observes Mr. Haworth, *Lepidoptera Britannica*, p. 56, "is at once the largest and the only one as yet discovered of this order of insects which is endowed with the powers of voice, almost every individual of the insect world, the hymenopterous part excepted, is mute. My tutor in entomology once had a male and female of *A. atropos* brought him alive in the winged state, both of which, when he had occasion to destroy them, uttered plaintive sounds, which he compared to the squeaking of a mouse." He then proceeds to give an account of the various sounds produced by insects, all of which we may observe are not caused, as in the vertebrated animals, by the aid of air which is respired, but by some external apparatus designed for such particular purpose. The cry of the Death's-head moth does not appear however (as Messrs. Kirby and Spence observe) to be produced by the wings, for when they as well as the thorax and abdomen are held down, the cries of the insect become still louder ; according to Schröter, the noise is accompanied by the rubbing of the tongue against the head,—whilst Roesel considers that it is produced by the friction of the head and thorax. Reaumur, however, thought it was caused by the friction of the tongue against the palpi, as he found that it ceased when the tongue was unfolded by the assistance of a pin ; as was also the case when the palpi were prevented from touching it : so also, on cutting off one of the palpi, the noise became more feeble. M. Passerini, however, has lately investigated the subject anatomically, and traced the origin of the sound to the interior of the head, in which he discovered a cavity at the passage into which the muscles are placed for impelling and expelling air ; the cause, as he thinks, of the sound in question. M. Dumeril has since discovered a sort of tympanum stretched over the cavity, like, as he says, to the head of a drum (*tendue comme la peau d'un tambour*). Other opinions have been given by Messrs. Lorrey and Duponchel, for which we must refer to Mr. Stephens' invaluable work, vol. 1, p. 117. The caterpillar of this insect, also, if alarmed, draws suddenly back, making at the same time a rather loud noise, somewhat like the crack of an electric spark.

Our readers will not require to be reminded of the numerous instances in which the accidental appearance of insects in more than ordinary numbers has been regarded by the vulgar with astonishment and alarm : hence it is not surprising that the sudden visitation of the Death's-head moth should be regarded as ominous and as the forerunner of death. Latreille, (*Hist. Nat.* 14, 128,) tells us that it appeared one year

in Brittany in great numbers, and as at this period an epidemic malady was raging with much violence, the mortality was attributed by the ignorant to the harmless moth.

Another peculiarity connected with the history of this moth, consists in its attacking bee-hives, ravaging the honey, and dispersing the inhabitants. It is singular that a creature, with only the advantage of size, should dare, without sting or shield, singly to attack in their strongholds a people so numerous and so well armed with means of defence ; and still more singular that, amongst so many thousands of bees, it should always contend victoriously. Huber, who first noticed this circumstance, thus reasons upon the subject.—"A moth is the dread of superstitious people, may it not also exercise a secret influence over insects, and have the faculty either by sound or some other means of paralyzing their courage. May not such sounds as inspire the vulgar with dread, be also the dread of bees." The same author states, that he was eye-witness of the curious fact that the bees, as if expecting their enemy had barricaded themselves by means of a thick wall of propolis and wax, completely obstructing the entrance of the hive, but penetrated by passages for one or two workers at a time, thus securing themselves, by an admirable sagacity, against the inefficiency of their weapons and their courage. "The art of warfare amongst bees," he adds, "is, therefore, not restricted to attacking their enemies ; they know also how to construct ramparts as shelter from their enterprises, from the part of simple soldiers they pass to engineers," instructing us that at the season when the moth appears, when too wasps and bees attack the hive, it is advantageous to narrow the entrances to the hive, so as to prevent the depredations of these obnoxious insects.

The moth appears in the winged state at the close of the autumn, the caterpillar being full fed at the end of September, and a very few weeks only being required to bring the moth to perfection. The caterpillar is very large and handsome, being of a pale greenish yellow colour spotted with black, with several lateral oblique stripes of beautiful blue and green. It feeds upon the potato, as well as occasionally on the jasmine, artfully concealing itself in the day time on such parts of the stems of the plants as are best covered with overshadowing leaves, but although they feed well, and complete their transformation to chrysalis, it is difficult to obtain them in the winged state, generally dying during their pupation. "Perhaps," observes Mr. Haworth, "in a state of nature they perform their extraordinary metamorphoses deeper in the ground, and consequently in a moister and more equal temperature than most other species of *Lepidoptera* ; and, if so, the cause of their perishing in our breeding cages is, undoubtedly, owing to their having in these cages too scanty and too dry a soil." We have known specimens obtained in the winged state, by placing them upon potatoes growing in pots in the open air, plunged into the earth, and the plant covered with gauze. The caterpillar has a curious horn upon the back, near the extremity of the body.

DEATH WATCH. A small coleopterous insect belonging to the section *Pentamera*, family *Ptinidæ*, and genus *Anobium*, which lives in timber and wood-work, and makes a slight noise, somewhat like the ticking of a watch. As in the Death's-head moth, we have here an instance of that lamentable proneness, amongst the vulgar and uneducated, for investing the

most simple and harmless objects with the most fearful powers. Swammerdam, speaking of this insect, says, "I have likewise the small beetle, which having firmly and strongly fixed its foremost legs, and bent and put its head through the space between them, makes a continued noise in old pieces of wood, walls and ceilings, which is sometimes so loud that upon hearing it people have been persuaded that nocturnal hobgoblins, ghosts and fairies wandered about them. I think that this may be properly called *Sonicephalus*, or the noisy-headed beetle." Hereon we may observe that Swammerdam's countrymen, the Dutch, do not from his account appear to be so far gone in superstition as the English, by whom this noise is considered ominous of death. Thus Gay, in one of his pastoral dirges, says—

The wether's bell
Before the drooping flock toll'd forth her knell,
The solem death-watch clicked the hour she died.

And Swift thus satirically alluded to the same insect :

A wood-worm,
That lies in old wood, like a hare in her form,
With teeth or with claws it will bite or will scratch,
And chambermaids christen this worm a *Death-watch* ;
Because, like a watch, it always cries click ;
Then woe be to those in the house who are sick,
For sure as a gun they will give up the ghost,
If the maggot eries click when it scratches the post.

The insect, generally considered as the real death-watch, and of which various figures have been published in popular works upon natural history, is the *Anobium tessellatum*, having the wing-covers of a dark brown colour, spotted with tessellated markings. This species, however, is found in old standing trees ; whereas it is evident that the insect in question must be one which feeds in-doors upon timber worked up into articles of furniture. At the present time (the beginning of July), clicking is to be distinctly heard upon the ceiling and window-frames of houses in the country produced by various specimens of this insect (which we have figured from living specimens), and which is of a much smaller size, and more uniform colour than the preceding, being the *Anobium striatum*. This noise has been considered to be the call or signal by which the sexes are mutually attracted to each other, and as analogous to the call of birds. The general number of successive distinct strokes is from nine to eleven, given in pretty quick succession, and repeated at uncertain intervals ; and in old houses, where the insects are numerous, they may be heard during the warm weather almost every hour of the day. The noise exactly resembles that made by beating moderately hard with the finger on a table, or rather, we should say, to scratching the top of a chip-box with the point of a pin. Mr. Stackhouse long ago observed the manner in which the noise is produced. The insect raises itself upon its hinder legs, and, with the body somewhat inclined, beats its head with great force and agility against the place on which it stands. On disturbing it, the head is drawn close to the front of the thorax, so as to have the forehead quite perpendicular ; the legs are folded up, and the antennæ lodged in recesses between the head and thorax, so as to be quite imperceptible. From these, and other recorded observations, it is evident that, in its perfect state, the insect makes this ticking noise, and also that the noise is produced when the insect is at large. We

have, however, more constantly heard the noise in the interior of wood-work, and it has hence appeared more than probable that the noise (and it is now frequently to be heard within the wood, when the insects are arriving at their beetle state) is caused by the newly-hatched beetle eating its way through the wood to arrive at the daylight. The metamorphosis of the anobia take place near the surface, the larva taking the precaution of making its way so close to the surface, that only a very little space remains for the perfect anobia to bore through. Hence we infer that the noise is produced by the action of the jaws of the beetle upon the wood, and in this manner only can we account for the fact of the ticking being heard (see Mag. Nat. History, September, 1834) throughout the winter, at a time when the insect is in the larva state, the larva itself also producing the same noise by the similar action of its powerful jaws, in gnawing away the wood, so as to leave but a feeble barrier through which the perfect insect can pierce with facility. Olivier indeed supposes that it is for the purpose of ascertaining the thickness of this barrier that the noise is occasioned. We, however, would refer it to the simple action of gnawing, which, of course, is applicable both to the larva and perfect states. There are not fewer than eleven species of beetles described by Stephens as belonging to the genus *Anobium*, and it is probable that the majority possess the same powers of making the ticking noise above described ; but it is evident that the true death-watch must be that species which resides in old wood furniture, and which we have figured beneath.



Death Watch, natural size and magnified.

There is also another insect common in old wood furniture, books, &c., both sexes of which have the power of making a ticking noise, but not so loud as the others. This is the *Atropos lignarius*, for an account of which see our article ATROPOS.

DECACERA. In the arrangement of modern malacology constituted the second family of the first order *Cryptodibranchiata* ; first class, *Cephalophora*, including the genera *Loligo* and *Sepia*.

DECAPODA—Ten-legged. An order of crustaceous animals, comprising all the larger species of the class, and well characterised in having ten legs ; the head intimately united with the thorax, and covered by a large shell or shield ; a mouth, consisting of numerous pairs of organs, of which the outer pairs, in some of the species are elongated ; but the most characteristic trait consists in the existence of gills or branchiæ, more or less numerous, fixed in a peculiar cavity beneath the sides of the shell.

This order is divided into two sections, namely, the *Brachyura*, having the abdomen shorter than the thorax, beneath which it is folded in repose, and not furnished with a terminal fan-like tail : the common crab is an example of the first section ; and second the *Macroura* having the abdomen longer than the

thorax, beneath which it is not folded at rest, and is furnished with a fan-like tail. The lobster, prawn, &c. are examples of this section. See also *Crustacea* and *Brachyura*.

DECIDUOUS CYPRESS. Is the *Schubertia disticha* of Mirbel, the *Taxodium distichum* of Richard, and *Cupressus disticha* of Linnæus. Richard's name is most generally adopted. It is one of our most beautiful deciduous forest trees.

DECUMARIA (Linnæus). A genus of North American twining shrubs, belonging to *Dodecandria Monogynia*, and to the natural order *Myrtaceæ*. Generic character: calyx bell-shaped, limb of from seven to ten teeth. Corolla consisting of from seven to ten oblong petals. Stamens numerous, filaments filiform, anthers twinned: style cylindrical; stigma a many rayed head; capsule valveless, many-celled, seeds oblong. This plant is used in gardens for covering trellises or naked walls, grows in any soil, and is propagated by cuttings.

DEER—Cervus. A genus of ruminant mammalia, having solid horns, which consist entirely of bone, without any case or sheathing of horny matter; so that, though they are the most largely developed and splendid head-gear in the whole of the animal kingdom, they are in truth not horns but bones, covered in their early stage with skin and hair, exposed when they come to maturity, and ultimately healed off at the close of the season; the peduncle to which the horn is attached being a complete cicatrix, and not a sore, and it soon skins over, under which skin a new horn begins to sprout soon after the old one is shed, comes to maturity, and is shed again; and so on during the life of the animal.

These annual horns belong only to the male in most of the species; but in the rein-deer the female also is furnished with horns, only smaller than those of the other sex. The case of this species supplies us with a physiological fact, from which we can form a pretty accurate judgment of the connection which this immense annual production of horns, that is of the matter of bone, has with the general economy of the animals. The horns of the two sexes come to full maturity at nearly the same time, that is, as the pairing time approaches, or the "rutting time" as it is called in the case of animals of this genus. As soon as this important period in the economy of the animals is over, the horns of the male begin to loosen at their bases, which they do first at the circumference, and gradually inward, till they drop off. The horns of the female again remain the whole of the winter, and do not drop off until her grand labour in the continuation of the race is accomplished—that is, not till after she has dropt her fawns. What purpose these horns may answer in the economy of generation, it is not easy to say; but as they continue in the male only till pairing, and in the female during the whole period of gestation, and as they drop off in both as soon as these great labours of the year is over, it is evident that they have some connexion with the sexual system of both, and that in the female this connection is with the uterine, and not with the mammary system.

In all the *ruminantia*, as will be more particularly explained in our general article upon that most valuable class of animals, there seems to be a much greater concentration of the energy of the animal upon the time, the act, and the progress of reproduction, than there is in many other races, though we find it more or less in most of those which are exclusively vege-

table feeders, and it always becomes less and less as the animals become more carnivorous. Though we might expect this, it is so important a fact in physiology, that we shall offer a passing remark upon it.—All the grazing, or vegetable feeding animals, have labour in the procuring of their food, and those which browse the thin herbage upon the thirsty plains have considerable labour; and, therefore, they are compactly made, clean limbed, and fleet-footed. But not one of them requires to take its food by force or effort, to chase it as the dog does, or spring upon it as the cat. The food being fixed to the ground is peaceably taken; and, therefore, the general habit of the animal is not a habit of excitement. Unless, therefore, the animal lives under the exciting heat of an inter-tropical climate, we can hardly suppose that there would be sufficient excitement in it to bring it up to a degree of energy required for nature's greatest work. On the other hand, the carnivorous animal is kept in a state of constant excitement, in watching for, in coursing, in capturing, and very often in fighting severely before it overcomes that upon which it feeds; and, besides this, the food of the carnivorous animal is more stimulating than the grass, the green leaves, the withered branches, the bark, and, in the case of some the present genus, the dry lichen, upon which the *ruminantia* feed. It should seem, therefore, that a means is required of keeping up throughout the year, a portion at least of this energy which requires to be called forth at one period of it; and the elaboration of horns appears to be the means by which this energy is kept up in the genus *Cervus*.

This genus affords many other confirmations of this, in the different productions of the appendages of the head—to which, by the way, it is better to give the name of *antlers* than of horns, even though the antler is strictly speaking the "brow snag" of the horn; *attire* is the hunter's name for them. In proportion as they inhabit near the equator, the horns are small; and as we come toward the polar countries they increase in size, and acquire their maximum in the extreme north, where a single pair of horns of the American elk, or moose deer, often weigh as much as sixty pounds. In the south, too, the females never have any horns, nor even in the polar countries till we come to the very last species, the rein-deer, which dwells with man, and is a most useful servant of all work, and means of subsistence to him in climates where no other vegetable feeder can exist.

In the north, too, we find the deer of much larger stature than they are in warmer climates; and this is an additional confirmation of the necessity of furnishing the vegetable feeders of the extreme latitudes with some permanent energy beyond that which is required for the mere purpose of feeding, in order that they may continue their race, keep their post, and preserve the balance of nature in those climates where life has, for full four months of the year, to maintain itself against cold sufficiently intense for freezing mercury, while for two or three months in the opposite part of the year, every living thing is scorched by the ardour of a never-setting sun. It is in these grand adaptations that we see most strikingly the oneness of the system of creation, and catch glimpses of that splendid science, that incomprehensible wisdom of design, which runs through the whole, and which preaches more eloquently than the tongues of men or of angels.

Those who have not thought much upon such subjects may be apt to imagine that, as the horns of deer

are in highest perfection at the time when the energies of the animals are required for the performance of those functions, at the close of which the horns drop off, the energy is most occupied in the horn, at the very same time that it is required for the other purpose; and that, therefore, the horn is a source of division and weakening of the energy, and not a concentration and strengthening of it. But when they call to mind that it is during the growth, and not when full grown, that the horn exhausts the energy of the animal, that the growth is most rapid in the early stage, and that the growth ceases when the skin comes off and the bony part of the horn is left bare, it will at once be seen that there is no ground whatever for such a supposition, but quite the reverse. There is something very analogous to this in the flowering of plants, which will probably suggest itself to the reader, but the introduction of it here would be out of place.

With the exception of these climatal adaptations, the deer form a more distinct and perfect genus than any of the other ruminantia, or, indeed, than almost of any group of any other order whatever; and, therefore, though there have been some attempts to separate them into sub-genera, the distinctions upon which these have been founded are more fanciful than real. The species are tolerably distinct, even when they are found in the same countries; but even there each species affects a different pasture; and, therefore, though we describe them according to their different appearances, the real distinction is one of sociality.

Here we are somewhat unexpectedly brought back to the physiological doctrine which we are attempting, for the first time we believe that it has been attempted, to explain—or, perhaps, to speak more becomingly, which we are seeking to bring to the notice of those who are capable of explaining it; for the explanation points much farther than even most physiologists are in the habit of looking, or even dreaming (for they dream homewards, and not on the long view); and we very much suspect that, if clearly worked out with constant adherence to the facts, and the whole volume of nature open to the investigator, it would be found as wide as the entire working creation, both animal and vegetable.

We may just notice that among birds, the gallinaeous ones, and others which, though not exclusively vegetable feeders, as indeed no birds are, yet never fight with what they eat, are the ones in which the male undergoes the greatest change of plumage as the pairing season comes on.

There is yet another point: among those birds which change their plumage toward the pairing time, the species in which the males are polygamous have the greatest and the richest change of feather in them. So also in the deer there is one species which is not polygamous, and in this species there is less development of horns, and also less excitement in the season of heat than there is in those where the males are polygamous.

The chief ground of specific distinction in the genus *Cervus* is the form and production of the horns; and this we might be prepared to expect from what has been already stated, or if we are to take the forms of the horns as an observed fact (which of course it is), it is a further argument in favour of what has been stated.

Deer have been in all ages of the world among the most interesting of its wild inhabitants. There is

majesty in their appearance, there is fleetness in their march; their flesh is more esteemed than that of any other animals; and when they are “in pride of grease” as it is called, they are in higher condition than any other animals ever are in a state of nature, or can be brought to by all the arts of the most skillful cultivator. Beeves and muttons may be fatted *ad nauseam*; but after a moderate point, as the fat accumulates the flavour goes; and a haunch of venison from the hill is, in point both of juiciness and of flavour, superior to all the beef or mutton that ever was fatted. As a proof of its superior wholesomeness we may add, that, even in the hottest weather, venison is hardly ripe in double the time in which beef or mutton would be putrid. The common-blue bottle fly tells tales in this respect: that insect is attracted by the scent of incipient putridity, as blue bottles may be observed most plentiful about those butchers’-shops where both the shop and the meat are in the worst condition.

The fleetness and watchfulness of deer, the boldness with which the males turn on their pursuers when pressed to extremities, and their value when caught, have made them at all times the most favourite game with the hunter, both for killing with missiles in the woods, and for running down by dogs in the open places. Indeed, it is highly probable that it was the deer which taught mankind the use of the bow in many countries in the earlier periods of their history, though Canning in his exquisite satire, “The Progress of Cruelty,” bestows the honour of having suggested this invention upon the pig—in his eager desire to eat which, the wild man applied the barked string to the bended branch, laid the pointed reed across, drew with all his might, let slip, and

Twang sounds the string, the hissing arrow flies,
And darkness seals the gentle porker’s eyes.

While great part of England was covered by extensive forests of timber, the shooting of deer formed, in the season, the occupation of kings, and feudal lords and their vassals, and, except in trying their weapons upon each other, it was almost their only amusement. It also formed a stock theme with the romancers and poets of the time; and, though it is partly true and partly fabulous, there are few of the remains of the lore of the middle ages which has had more readers and admirers than the story of Robin Hood and his band in Sherwood Forest. Nor in the more open parts of the country was the wholesale slaughter of the deer by driving in one way or other a less celebrated employment; and when “the stout Earl of Northumberland” wished to bring the feud with the Douglas to an issue, he had recourse to a deer-stealing incursion upon the grounds of the latter:—

To drive the deer with hound and horn,
Earl Percy took his way;
The child may rue that is unborn,
The hunting of that day—

as is said and sung in the very beautiful and truly national ballad of Chevy Chase. Innumerable other instances might be cited to show the importance which our forefathers attached to these animals; and it is probable; nay it is certain, that to the fondness both of men of rank and of men of no rank for deer, we are indebted for the brightest ornament not only of English literature, but of the literature of all nations.—William Spakspcare was a deer stealer, and as such was driven from his native county to seek shelter in the British metropolis, and make his way there the

best way he could ; and, from the miserable doggrel in which he vented his indignation against those who had punished him, there is every reason to conclude that if Shakspeare had remained in the country, he never would have been the author of one readable line. Therefore, the deer may be said to have given us more than man by force of armies, or by strength of reasoning, could have given us—it has given us Shakspeare.

Deer belong more to wild than to cultivated nature ; and more to the rude and early stages of countries than to the more polished and advanced periods. They are also inhabitants of northern climates rather than of central ones ; and in the extreme south are unknown as native animals. They are found throughout the continent of Europe and Asia, and in the more proximate Asiatic isles ; but there is not a vestige of them or of their remains in any of the islands of the great South Sea, in Australia, or in Africa, as native animals. They are found, indeed, in the north of Africa, on the slopes of the mountains of Atlas, but there is not the least doubt that though now naturalised there, they were originally imported : there is not a vestige of them to the south or the east of the desert of Sahara, though all that part of Africa swarms with antelopes ; and the southmost of the Asiatic isles in which they are met with is Timor, where the species is very small, and by no means abundant.

In America, their grand head-quarters is the north, though they continue downwards along the mountain slopes, and in the extensive forests, a good way into South America ; but although there are several species in that part of the western continent, it does not appear that there is even there any one which can, with propriety, be called an Antarctic or southern deer. Thus we may regard them as being properly animals not merely of the northern hemisphere, but of the extreme north, for the species which are found there are of far greater size than those farther to the south, and also more abundant in numbers.

Although some of the species are comparatively tame, and one in particular, the rein-deer of the north of Europe, is in a state of complete domestication, yet, as a genus, they cannot be ranked among domestic animals, and they fade away before the progress of cultivation. In the state of nature, they, generally speaking, frequent grounds which are rather rich, and most of them either the woods or their margins. Some of them are fond of marshes, and the banks of streams, and even take to the water at a certain season of the year, and all of them can swim. In locality and food the species differ a good deal, so that we shall mention these particulars along with our notice of the species themselves.

The following are the generic characters : eight incisive teeth in the lower jaw, but none in the upper ; no canine teeth in most of the species, though some have them in the upper jaw ; six grinders above and below on each side ; head long, terminated by a muzzle, and with the upper lip more or less elongated and prehensile in the different species ; the ears very large ; the eyes bright and clear, with the pupil elongated ; sub-orbital sinuses, or slits under the eyes, in the greater number ; tongue soft ; no gall-bladder ; the female with four mammæ in the groin.

As, in the former part of this article, our physiological remarks on the use of the horns in the economy of the animal took our attention from the description of them, and as that is a sort of technical matter,

which it is sometimes reckoned unclassical not to know, we shall mention a few of the particulars. The ring of irregular protuberances which surround the horn at its base is called the *burr* ; the main stem of the horn is called the *beam* ; the divisions on the upper part of the beam are called *branches*, or *snags* ; and the branches next the brows, of which there is one, two, or three, according to the species, and there are occasionally, but rarely, some irregularities in the same species, are called *antlers* ; and the first of these is called the *brow-antler*, and the second the *bezantler*. The rudimental horns, which appear the first year, but they do not make their appearance till the year is out, that is, till the summer after they are dropped, are called *prickets*, and the little protuberances on them, which mark the rudimental antlers and branches, are called *dags*, which name is also sometimes given to the prickets. In some of the species, and it is most remarkable in the southern ones, the beams and branches are all slender, and nearly round in their sections ; but in other species, and most conspicuously in the most northern ones, the beams, and in some also the antlers, have flattened extremities, which are called *palms* ; and when the beam is much palmated, the terminating branches are usually short snags. In the stag, when full grown, snags appear on the front edge of the upper part of the beam, or the forward branch, in which case the animal is called a “ fore-hand stag.”

During the time of its growth the horn is sentient, and bleeds when wounded, and a wound upon it will sometimes occasion the production of an additional snag. The following is an account of the progress of the horn :—At first a slight protuberance appears covered by the skin, where a great number of vessels are spread, for a considerable degree of heat is perceptible under it. Soon the protuberance rises, and in some species branches off into ramifications. After a certain period, the development is arrested, the skin, which had continued to stretch and extend over the whole production, loses its heat, dies, becomes dry, and finishes by tearing off in rags. At length the horn itself becomes detached, and falls ; a slight hemorrhage follows from the skin, or the part of the frontal which sustained it. In the course of twenty-four hours, in healthy deer, the vessels which emitted the blood are closed, a thin pellicle covers the wound, and immediately the reproduction of a new horn becomes apparent ; the extremity of the vessels swells, a burr expands around the base where the late horn stood, resembling those on the bark of trees when they have received wounds which begin to cicatrize ; the burr widens, while the vessels which proceed from the bone deposit osseous matter. Hitherto the development of the horn has been uniform, the vessels have extended in a certain direction, always the same in each species ; but when they have arrived at a certain point, they separate, some continuing as before, while others turn into new, but always invariable directions, if no accident impedes them. The horns of each year come up with a branch or snag more than in the preceding year, so that they serve for a sort of register of the age of the animal. No male deer is said to be “ of the first head,” till there are five snags or branches ; and after that he is counted, and ranks in hunters’ honours by the number. When he is “ a stag of ten,” he is accounted a noble animal.

In giving an account of the various species of deer,

we shall take them as nearly as possible in the order of their locality from the north southward, subdividing them at the same time into a sort of three groups, which, however, are also local groups—those which are found both in the eastern continent and in America—those which are found in the eastern continent only—and those which are found in America only.

I. DEER COMMON TO BOTH CONTINENTS.

REIN-DEER (*Cervus tarandus*). This species is the *Reen* of the Laplanders, and the *Carabou* of the natives of the extreme north of America. There have been doubts raised as to its identity in the two continents, but these doubts do not appear to be well founded, as in both countries the manners and general appearance of the animal are the same. It is the most polar of the whole genus, subsisting where no other ruminant animal could subsist, and upon food which could support scarcely any other animal; and it is as gentle in its manners as it is endearing, being all in all to the Laplanders, where no other animal can be of use to them, either for labour, or, in as far as ruminant animals are concerned, for food. In the more northerly parts of Europe it is alone, but in the north of America it blends with some of the other species. This is not, however, owing to any difference in the animal, but to the difference of the countries. The winter in Lapland is much milder than in the north of America, even in latitudes much farther to the south; and the Lapland summer is not so burning as that of America; therefore there is a difference in the seasonal shifting of the quarters of the animal. In Lapland it goes to the mountain in summer, and descends to the valleys in winter; and as the sea is not frozen even at North Cape, the cold of the Lapland winter is not excessively intense. At the north of America, on the other hand, the sea is completely frozen over, the cold is extreme, and, from the depth of the snow, food for the rein-deer there is altogether inaccessible. In consequence of this, it migrates more to the south, or farther in latitude than in Europe.



Rein-deer.

Rein-deer vary considerably in size; and we have this proof, that though they are docile, and breed in a domestic state, that state is not quite congenial to them; that they are always of more diminutive size when domesticated than when wild, even though they should happen to be better fed. In the wild state, the full-grown male is equal in size to the full-

grown stag, or perhaps even larger, but its legs are more clumsy, its body is more squat, and, altogether, it is a much less graceful, as well as a much less courageous animal, than the stag. In the general shape of its body, it bears some slight resemblance to a calf. The neck is very short, the head carried in a line with the back, and, altogether, the aspect of the animal is heavy. Its body is covered with two sorts of hair, one having considerable resemblance to the hair of the rest of the genus, and, like that, having a narrow neck at the insertion of each hair into the skin. This form of the individual hairs is, so far as we are aware, common to the whole genus, and might, on that account, be made a character, as it is not met with in almost any other animal. The hair has something the form of an old-fashioned lance, which was thickened toward the handle, to give it stiffness, then had a narrow place for the hand to grasp, and beyond that another thick portion for fixing, or setting on the rest. In the hair of the deer the latter portion is inserted in the skin, a small part close to the skin is a mere filament, and then the remaining, or principal part of the hair, is thick, and tapers to a point. In consequence of this formation, the hair easily separates; but it lies flat, and does not stand on end when the animal is excited, as hairs do which are thick at the roots. This answers to not unimportant purposes. In the first place, when the animal is exposed to rain, the hairs fall flat over each other, and throw off the water like a roof; and in the second place, these flexible-rooted hairs give way to the air much better than stiffly-rooted ones would do, and, in consequence, the animal is less fatigued while making its escape from its enemies. Besides this hair, which is common to all the genus, the reindeer has short woolly hair among the roots, as is the case with most animals of very cold climates. In winter, there is a third kind of hair, which is long, only thinly scattered over the upper part of the body chiefly, and of a whitish colour.

The colour of the rein-deer hardly admits of any definite description, for there are great varieties even in the wild state, and, as we might expect, the colours of the domesticated ones vary almost as much as those of cattle. There is what is understood to be a sort of typical marking, namely, brownish, with white, round the mouth and the horns, and also on the shoulders, extending in a bar to the flanks and rump, and under the tail, and white also round the hoofs. The belly, and insides of the limbs, are also generally white; but some of the wild ones, and many of the tame, are white all over. The fawns are generally brown on the upper part, reddish on the under, and dappled with white spots.

The horns of the male are generally much produced and broadly palmated, being sometimes as much as four feet long; those of the females are much smaller, and have the palms narrower. No fixed account or representation can be given of the form of the fawns, but in general the beams are thrown back from the forehead, and then bent forward with a considerable sweep. On their front sides they bear two branches, which are sometimes simple antlers, and at other times palmated or snagged. The remaining snags are on the back of the curves.

The males drop, or, as it is called, *mew* their horns about the month of November; and the females, when not in fawn, drop theirs at the same time; but,

as already mentioned, the females which are in fawn do not drop their horns till they have brought forth. If the male is mutilated, it has the effect of making the horns remain on for one whole year; but after this they are shed at the same season as those of the entire animals; and, as is the case with cattle, they increase rather than diminish after the operation. This might be expected, inasmuch as the energy which is divided in the entire animal goes wholly to the formation of horns in the other. The rutting season is in October, at which time the males grow something in the same manner as fallow-deer. They have an apparatus in the throat, which we believe has not been detected in any other of the genus, namely, a membranous sac, between the thyroid cartilage and the *os hyoides*, opening by a slit into the larynx, and capable of being inflated with air, somewhat similar to that in the howling monkeys; but what effect this may have on the sounds which they utter has not been ascertained.

The fawns are usually dropped in May, they are one or two, but rarely three; when dropped they have rudimental horns, and these become snags an inch in height in the course of two weeks, so that in this respect they differ from all the deer of warmer climates.

They are excellent swimmers, and ride so lightly in the water, that half their backs are above the surface; their broad feet strike with great force, and impel them so fast in the strongest currents and across the broadest rivers, that a boat well-manned can scarcely keep pace with them. When defending themselves, they strike downwards with the horns, but do not gore; they kick with violence, and repel the wolf with success; but their most dangerous enemy is the glutton, who is reported to drop down upon them from the branch of some tree while they are off their guard, and both that animal and the bear are apt to watch in trees, and drop down upon them as they pass. The feet of the rein-deer produce a cracking noise when they run, by the hoofs striking against each other.

Rein-deer are remarkably well provided with the means of finding their way. The nictitating membranes of their eyes move with nearly the same facility as those of birds; so that they can proceed directly against the heavy falls of snow which are so common in that country in the early part of the winter. Their sense of smelling is equally acute; and by that alone they can not only find their way in the darkest nights, but conduct their master with perfect safety in his sledge, at times and through places where human sagacity would be utterly at fault.

There is no animal, indeed, so serviceable to man in any country as the rein-deer is to the Laplander; and if he were deprived of it he could not by possibility exist. With its assistance, however, his condition is more comfortable than one would readily suppose, and there is nothing which he could substitute in the place of this most useful animal. It feeds upon those plants which form almost the extreme of vegetation,—the buds and twigs of the small arctic shrubs, and the lichens which grow abundantly where nothing else will grow; and thus he does not require to sow grasses, prepare meadows, or cultivate any sort of vegetable, but may be said to obtain the labour of this excellent servant for nothing. All that he has to do is to protect his little herd from the bear and the glutton, and guide them to their changes of pas-

ture as the different seasons of the year require. In the wild state they are gregarious, and when domesticated they are perfectly social, very much attached to each other, and obedient to the orders of the herdsman; an elder of the herd generally takes the lead, and the rest follow him with a most willing obedience. The herdsman teaches this leader to obey his whistle, and the rest will follow after, at almost any signal, such as a stamp of the foot, or even a look. They draw the sledge over the snow with great rapidity, and apparently with less fatigue than any other animals of draught. No doubt the hard and smooth surface of the snow is a sort of railway, or at least bears some resemblance to it; but still it is no small feat for two deer to draw a man in a sledge over “three skies” of the Lapland mountains in twenty-hours. A “sky” is a mode of estimating distance understood in most mountainous countries; it was once very general in the islands of Scotland, and is still used in those places where there are no roads. It means a new horizon, which the traveller obtains every time that he comes upon the top of a new hill. These skies are, of course, of very different lengths; but from the character of the country the average length of three taken together may be reckoned at not less than one hundred miles; and we are not aware of any other means by which a man could be drawn the same distance over snow during twenty-four hours of a sunless night.

But this is not the only advantage which the Laplander derives from the rein-deer: the flesh of the animal is the most substantial part of his food, and its milk serves him in various ways. It is used recent; it is coagulated into cheese, the whey is used for drink; and we believe in some instances fermented and distilled into a liquor something analogous to that which the Tartars make from the milk of the mare. The skin of the rein-deer, which is warm and strong and pliant, serves for a clothing, for blankets, for covering the sledge, and for almost every purpose for which we apply cloth or leather. The tendons, which are very tough, furnish thread; the horns are manufactured into a variety of domestic utensils; and even the intestines of the animal have their domestic uses, while the tongues, which are considered luxuries in most countries, give even the poor Laplander an export trade, and make even him a citizen of the world.

There is no country in Europe so much infested with the plague of flies as Lapland, especially in the swampy and shady places, where the gnats are almost as tormenting as the mosquitoes in tropical countries; to escape from these the Laplander and his herd take to the open hill in the summer; but even there the animal is not secure from insect annoyance. Even in the most elevated and airy of its mountain pastures, the rein-deer gad-fly (*Æstris tarandus*, Linnæus,) finds out the herd, and the hum of a single insect is sufficient to throw the whole into a state of the greatest agitation. The object of the fly is to deposit its eggs under the skin of the animal, which it generally succeeds in doing; and it is said to be when the rein-deer are about two years old that they are most annoyed by this insect.

Estimated by this, his most valuable possession, the Laplander is often a man of no small wealth, for his herd sometimes amounts to as many as a thousand; and as two is the average production of each, and the number of females far exceeds that of males, this herd furnishes him with an abundant supply of all the

necessaries of life ; and from the different numbers which different individuals possess, and some being without any, there are grandees and paupers in the wastes of Lapland, as well as in the most fertile and thickly populated countries in the world.

In Lapland properly so called, and in all the country northward to the Gulf of Bothnia, we believe that there are now few rein-deer in a wild state, if, indeed, there are any ; neither are they met with in the southern or lowland parts of Sweden ; but in the central province of that country they are still to be found in considerable numbers. It does not appear that the species ever existed in Europe to the south of the Baltic, though as we proceed eastward and the cold extends farther to the south, we find rein-deer farther to the south also. They range eastward over the whole continent to Asia, and northward to all the isles of the Frozen Ocean, whose icy plains afford a ready passage ; and from the structure of their feet they are well adapted for making rapid way upon the ice ; and, indeed, it forms a better passage than the land, as it is more level, and always covered with a coating of snow. They are met with in Spitzbergen, which is near the eighteenth parallel of latitude, where man, notwithstanding his flexibility to climate and his mental resources, is unable to endure the winter. On their migrations rein-deer no doubt frequently meet with their polar neighbour the white bear ; but we believe he is unable to come up with him on the ice.

The circumstance of no trace even of the bones of the rein-deer being found in a fossil state in central or southern Europe, decides that in all ages of the world, this has been strictly a polar animal ; and the fact of its seeking the verge of the Frozen Ocean, and journeying upon the ice, proof against the very extreme of the winter's cold, readily accounts for the fact of its being found both in Europe and in America. The continents approach one another very closely on the side of Siberia ; and even in the summer months the ice is so little way to the northward of Behring's Strait, that even then it would be no very arduous march for a reindeer to pass from Asia to America, or the reverse. It is probable, however, that the intercourse, if it is still kept up, takes place during the winter ; because at that season the animals descend, while in summer they seek the elevated spots.

These circumstances and the facts which we have mentioned of the variations of colour to which reindeer are liable, clearly establish that though there may be variations in the average colour of the reindeer of Europe, and the *Carabou*, as it is called in America, that they are the same identical species. The horns are said to differ at least in some of those which have been considered as varieties in America ; but these appendages differ so much even in the same herd, and sometimes in the same animal, for the one horn is often very differently shaped from the other, that no species or variety can be founded upon any variation of these. Whether the rein-deer passes along the polar ice from Spitzbergen to Greenland, we have no means of ascertaining. It is possible, though not very likely, that with the exception of this one break of its range, this most polar of all the ruminantia has unbroken command of the entire circuit of the earth ; and on this, its peculiar locality, as well as for its usefulness to man, in the land of his greatest necessities, the rein-deer is one of the most interesting of animals.

Before we pass to another species it may not be amiss to notice merely for the purpose of showing how unlikely it is to be true, that some naturalists have described the fossil horns found at Etampe in France, to which horns an animal has with most gratuitous ingenuity been added, under the name of *Cervus Guetardi*, as belonging to the reindeer ; but from what we have said of the variable nature of the horns, as well as from what we may call the demonstration by the late Cuvier, who was at once the most learned and the most cautious judge in such matters, there seems decidedly to be no truth whatever in the assertion.

THE ELK (*Cervus alces*). This is the next in order in geographical position, its locality lying immediately to the southward of that of the reindeer, and the two bivoculating with each other on their confines in the eastern continent, and still more in the western. The elk, which was once pretty numerous in central Europe, is now rare in that quarter of the world, though it is still not unknown. In America it is much more abundant, and inhabits further to the south, its head-quarters being the vicinity of the great lakes, and the forests on both sides of the St. Lawrence ; the whole of Canada in fact with New Brunswick, and also westward, at least as far as the Rocky Mountains, which come down upon the northern ocean ; or rather the Polar Sea to the westward of the debouchure of Mackenzie's River, in about 135° west longitude. It is not mentioned that the animal has occurred to the westward of those mountains, and, though not impossible, it is not by any means so probable as that the reindeer should be there ; for besides the elk having a less polarly situated locality, its habits are different. The reindeer is adapted to the dry lichen-clad hill in the summer, and to the snow in the winter ; while in summer the elk is more in the marsh, and sometimes actually in the water feeding on the submerged grass, and ever and anon blowing somewhat like a whale, and in winter it is more in the forest.

Still there is no reason to suppose that there is any specific difference between the elk, or moose deer as it is called in America, and the elk of the eastern continent. No doubt black elks and reddish elks, and sometimes also white elks, have been described ; but the elk is subject to very considerable changes of colour with age, the very old ones being apt to turn almost black ; while the young ones are chestnut coloured, and there is little doubt that the white individuals are albinos.

We cannot resist quoting the following very accurate and highly graphic description of the elk, from the pen of Colonel Hamilton Smith, whose monograph on the ruminantia forms the greater part of the fourth volume of the English translation of Cuvier's Animal Kingdom, published in the name of Griffith, which monograph most justly called forth the highest eulogium from the illustrious author of the original work. "This animal is the largest of this genus, being higher at the shoulders than the horse ; its horns weigh sometimes near fifty pounds ; accordingly, to bear this heavy weight, its neck is short and strong, taking away much of the elegance of proportion so generally predominant in the deer ; but when it is asserted that the elk wants beauty or majesty, the opinion can be entertained by those only who have seen the female, the young, or the mere stuffed specimens ; for we who have had the opportunity of view-

ing the animal in all the glory of his full-grown horns, amid the scenery of his own wilderness, no animal could appear more majestic or more imposing. It is, however, the aggregate of his appearance which produces this effect; for when the proportions of its structure are considered in detail, they certainly will seem destitute of that harmony of parts which in the imagination produces the feeling of beauty. The head, measuring above two feet in length, is narrow and clumsily shaped by the swelling upon the upper part of the nose and nostrils; the eye is proportionally small and sunk; the ears long, hairy, and asinine; the neck and withers are surmounted by a heavy mane, and the throat furnished with long coarse hair, and in younger specimens encumbered with a pendulous gland; these give altogether an uncouth character to this part of the animal. Its body, however, is round, compact, and short; the tail not more than four inches long, and the legs, though very long, are remarkably clean and firm; this length of limbs and the overhanging lips have caused the ancients to fancy that it grazed walking backwards. The hair of the animal is coarse and angular, breaking if bent."

The elk is an inhabitant of northern latitudes; in Europe between the fifty-third and sixty-fifth degrees, making a part of Prussia, Poland, Sweden, Norway, Finland, Lapland, and Russia. In Asia it is found farther south from thirty-five to beyond the fiftieth, spreading over Tartary, and abounding in Japan, if indeed the denomination of elk is not misstated for that of a rusa, or an undescribed species. In America it resides between the forty-fourth and fifty-third degrees, round the great lakes, and over the whole of Canada and New Brunswick.

Its movements are rather heavy, and the shoulders being higher than the croup it does not gallop, but shuffles or ambles along, its joints cracking at every step with a sound heard to some distance. Increasing its speed, the hind feet straddle to avoid treading on its fore-heels, tossing the head and shoulders like a horse about to break from a trot to a gallop. It does not leap, but steps without effort over a fallen tree, a gate or a split fence. During its progress it holds the nose up, so as to lay the horns horizontally back. This attitude prevents it seeing the ground distinctly, and as the weight is carried very high upon his elevated legs it is said sometimes to trip by treading on its fore-heels or otherwise, and occasionally to give itself a heavy fall. It is probably owing to this occurrence that the elk was believed by the ancients and the vulgar to have frequent attacks of epilepsy, and to be obliged to smell its hoof before it could recover; hence the Teutonic name of *eleud* (miserable), and the reputation especially of the fore hoofs as a specific against the disease.

During the winter months the elk resides chiefly in hilly woods, in snowy weather seeking the covers, and in clear the open spaces. In summer it frequents swamps on the borders of lakes, often going deep into the water to escape the sting of gnats, &c., and to feed without stooping. Its usual food in winter consists of the buds and bark of button-wood, spruce, and juniper pines, birch and maple, and under the snow it seeks stink wood (*Anagyris fetida*) and mosses, but this is always with difficulty, for then it is obliged to spread the fore legs, or even it is said to kneel. The branches of trees it turns down with the horns very dexterously; but to get at the ground we have been assured by Huron and the Canadian hunters,

when the snow has fallen only a foot or two in depth, that the herd, led by an old male, shovel it back, and throw it over their heads, the snow falling on either side, as it slides from the inclined planes of the back of their horns; meantime the fore feet of all are equally engaged in striking it from under them.

During a part of the year the herd consists of an old female, two adult females, two young females, and two young males; but during the snowy periods, at least in America, one or more adult males are certainly among them, very old males alone keeping aloof until the rutting season, unless the winter be very severe. Several of these families keep near each other, and in very cold weather they seek cover together, and remain closely pressed against each other, or trot in a circle till they have beaten the snow down. When the rutting period commences, which is about the beginning of September, the old males seek the females, and expel the young, who are obliged to keep aloof while the animals remain in heat. At this time they will swim rivers in pursuit of the females, or after them to remain concealed in some of the Lake Islands. The males are then very pugnacious; they bellow often and sink in flesh. The gravid females bring forth about the middle of May, at first one, but ordinarily two calves, of a brown red colour. These are so simple and void of fear that in the first months they are easily taken, and if in the water, where they willingly go to avoid the flies, they will suffer persons in a canoe to come up to them and take them by the head without appearing in the least frightened.

The dags, prickets, or incipient antlers are the first year not more than an inch in length; the second they rise to a foot; the third they are forked, and the fourth they assume six snags and are somewhat flattened; the fifth year the blade is still small, but their expansion from that time forward is uniform, though it does not appear that the number of snags ever exceed twenty-eight. In a very large specimen which we saw shot, there were twenty-two, the length from the head to the tip twenty-seven inches, and from tip to tip across the horns three feet six; the two lower snags on each side separated by a deep indenture; the weight about thirty-three pounds. Old elks shed their horns in January and February, and, if lean from a severe winter, in March; the younger later, till the month of May. They are again completely restored in the former by the end of June, and in the latter in August.

"An elk killed in Sweden is said to have weighed 1200 pounds, but this must have been a very extraordinary animal; their height is about six feet. A white specimen from Swedish Lapland, in the Munich Museum, five years old, is six Rhineland feet at the shoulder. A female figured by Mr. Heriot was seventeen hands high; the large male above alluded to was scarce four inches more, or about six feet, but he was very deep at the shoulders. Another, whose antlers were still more deeply indented at the base, that is with the parts corresponding to the brow and bezantlers of the stag, separated from the main blade by a deep intersection, was not more than seventeen hands and a half high. His head, from the nose to between the ears, two feet three inches; distance between the eyes eight inches; length of the ears nine inches and a half; the lower branches or snags were bifurcated and thirteen inches long, and their united amount was seventeen, with the rudiment of

an eighteenth. The hunters named him a black moose, and from the greater length of head in proportion to his height, and the particular form of the horns, insisted that this was a different species from the brown. There is however no character sufficiently distinctive to claim our assent to this assertion, for it is known that considerable variation in the horns occurs from various causes, although it must be admitted that the almost complete separation of the lower parts into the form of branches is a very prominent character in most if not all the American specimens, while a similar formation is rare in those of Europe, but the colours of the hair differ with the season; and if this specimen belong to a different species, both would be of that species, the result proving only that the European is not of the same. The two here mentioned were dark, almost black, with grey hairs intermixed, but that with the largest horns had the greatest intermixture of grey; they were killed on the borders of the Saquenai, in Lower Canada, where both they and a herd of buffaloes were considered as strangers. The darkest was shot in September, and the grey in November, which may account for the difference of colour.

"During the time that their horns are sprouting, the animals remain most in willow covers, returning to the evergreen woods when they are restored; their period of life does not exceed twenty years.

"They are hunted in North America chiefly during the early part of winter, and towards the spring. While the snows are not deep they are not easily attacked; but when they begin to harden, and the hunters run on snow-shoes, they endeavour to turn the game towards ravines, or where it is drifted deep. The Huron hunters have assured us that when this is effected he is sure to be soon entangled, and to flounder in it; but that they must be on their guard, and run instantly upon the deep snow to fire at him as he turns, because he will endeavour to double on his own track, and charge all that are then in his way. When first discovered, he is often found sitting on his hams like a dog, voiding his urine before he rises to escape. Against the bear and the wolf, he stands at bay with his horns, acting offensively only with his fore or hind feet; his kick is very powerful and quick; it is said that a small tree is splintered by it.

"The Indians are great admirers of the flesh, to us it appeared superior to the stag's; but under the circumstances which admit of this kind of banquet, it may be doubted whether a similar judgment would be passed in the comforts of a home; the nose and the tongue are admitted to be the best parts. Mr. Pennant states that they were once used to draw sledges in Sweden, but that it afforded to malefactors the facility of escaping, and that therefore the use of them was prohibited. The hide furnishes excellent leather and buff skins for belts."

It has sometimes been alleged, that the very large deers' horns which are found abundantly in the bogs of Ireland, and sometimes, though more rarely, in similar formations in Britain, are horns of the elk; and it has thence been inferred that at one time the elk was very plentifully found in the former island, and by no means rare in the latter. But there is no reason to conclude very dogmatically from the horns themselves, because, as we have already said, they are subject to great variations even in the same country and at the same time; and therefore we can

satisfactorily draw no conclusion from them as to what may have been the animal whose remains are so common in these deposits. But we have conclusive evidence that the animal to which those horns belong, and which must have been at least as large as a cart-horse of the present day, was a stag and not an elk; because the skeleton has been found, and the relative proportions of the bones are exactly those of the stag; but whether of the stag which is still found in the old continent, and which has degenerated in consequence of change of climate in the lapse of centuries, or of some more gigantic variety which is now extinct, we have no means of ascertaining; and therefore it would be idle to offer any conjectures on the subject.

That Ireland and many parts of Scotland, more especially the western islands, and the isles, have undergone a very remarkable climatal change is certain. They are now almost entirely denuded of timber, except a few wretched copses of underwood, and a few artificial plantations; and in both, black or red peat bog has come in the stead of what once were forests of the most gigantic trees. When those forests were in their prime—and glorious forests they then must have been, for the writer of this article has traced the remains of a single tree full 150 feet in length—when they were thus in their prime it is natural to suppose that they were inhabited by deer worthy of them; and that from whatever cause, or by whatever catastrophe, the goodly forest and its gallant inhabitants have faded away. It is generally said that the invaders of Ireland wantonly consumed the forests with axe and fire-brand, and as wantonly exterminated the deer, but this wants confirmation; and besides it does not come within the pale of natural history, and would not explain the phenomena in question although it did. When we look at the grand features of the natural world, we may put aside the small results of man's working; for there is a maturity and a decay in certain states of countries which man cannot greatly, or perhaps even sensibly, either accelerate or retard. Besides, we know of no such catastrophe in the parts of Scotland to which we have alluded; and there we find a few lingering remnants of the forest which tell us of its former existence, and that it has yielded to the powers of nature, and not to the hand of man. In many places there are the roots of yews with a small circle of the external or last formed wood still undecayed, and sometimes with green foliage the size of a feather upon some portion of the ample circumference. These were in the rich bottoms no doubt, but at all events they are now in the wilderness; and some of them measure fifteen or even eighteen feet across, so that they must have been giants in their day. Besides, in situations which are too bleak, and beaten by the winds and rain of the Atlantic, for suffering fungi to sprout and moss to accumulate for (such are the beginnings of a peat bog), there are still immense trunks lying bleaching, white and sapless, and unfit for affording nourishment to even the smallest fungus which can grow upon a fallen tree. This is not, however, the place to enter upon such subjects, though it is difficult to discuss the natural history of deer without at the same time thinking of the progressive history of forests, and being carried back in imagination to times when our country had far more of a natural majesty in it than it has at present, notwithstanding its arts and its wealth; and though our habits are such that we

would not willingly part with these, yet it is refreshing sometimes to glance back in imagination to those glories of the land which are gone for ever, until some convulsion of the globe shall depress our islands to "the oozy bottom of the deep," and let them rest there during the night and sleep of lands until another convulsion of nature shall again upheave them, like a giant refreshed, and fitted anew for giant plants and gigantic animals.

II. DEER OF THE EASTERN CONTINENT.

The two species which we have enumerated, namely, the reindeer and the elk, are the only two which can be considered fully established as inhabiting both the eastern continent and the western; and though the elk inhabits more southerly and in richer pastures than the reindeer, yet it is sufficiently far in the north for allowing the supposition that it may have passed from continent to continent upon the ice. Those which remain to be considered are the deer of temperate and of warm countries, which inhabit too far to the south for interchanging between the continents; and though there are exceptions as regards particular places, which are explainable by the different characters of those places, yet we may in general say that the size of the animals, and especially the development of the horns, diminish as we approach the southern limit.

In most countries, however, which are adapted to the race, and from which that race has not been exterminated by natural or artificial means, we may say that there are in general three species of deer, one affecting more the forests, another the open savannas or rich plains, and the third the more elevated and airy wastes. We may thus style them according to their pastures—forest deer, field deer, and hill deer. We have types of all the three in this country, though it is possible that the field deer, the one with which we are most familiar, but which partakes not of the majesty of him of the forest, or of the airy beauty of the mountaineer, may be an importation. We shall first notice these three in their order, and then briefly mention the foreign varieties.

THE STAG (*Cervus elaphus*). This is the deer par excellence in all works on "the noble art of venerie," and in all allusions to the bold foresters of merry England. It is the red deer, and the male is called a hart, and the female a hind.

The characters are, the horns round in their section, furnished with three antlers on each beam, turned to the front, and curved a little upwards; then the top of the beam terminates in a number of snags, all at nearly the same elevation, and increasing in number with the age of the animal. In summer the general colour is yellowish brown, with a black bar across the shoulders, and a row of pale yellow spots on each side. In winter the colour changes to a uniform reddish brown; but the hinder part of the rump, the tail, and a small portion of the feet above the hoofs (which we term the fesses), are always of a pale yellow.—Both sexes have canine teeth, which are rather long, and bent in the male, but the female has no horns.—The young fawns are of a rich yellowish brown, dappled with white spots; and it is from their ground colour that dyers give the name of fawn to a peculiar shade of colour, intermediate between brown and yellow. The colour deepens much with age; so that in winter the old stags are nearly black; but they retain the mark on the crupper and fesses.

The stag is by much the largest of European deer,

and the probability is, that the large horns above alluded to have belonged to the very species which is still met with in some parts of our own country, and more abundantly on the continent of Europe, where forests are far more extensive, and have been less disturbed. The rutting time of the stag is in September, the young one being driven off by the mothers in August, and during this season the males are in such



Stag or Red Deer.

a state of excitement, that it is not only highly dangerous to approach them, but they sometimes ill-treat and even kill the females. The hind goes a few days more than eight months with young, and drops her single fawn, for she has rarely two, in the month of May. It used to be fabled, that the stag was remarkable for length of life; but it does not appear that it lasts longer than about twenty years. It is found less or more in all places of Europe, where there is cover adapted for it, except in the extreme north and in very hot places near the sea. It is also met with in western Asia, in some of the mountainous islands of the Mediterranean, and on the slopes of the mountains of Atlas in northern Africa, where it appears to have been imported, probably by the Romans. But it has degenerated in that part of the world: it is smaller in size, more brown in the colour, and the horns terminate in forks, instead of the numerous snags which they display in colder countries. In these respects it approximates the characters of the Indian deer; and would lead one to conclude that the stag is very general on the eastern continent, only in the course of years it has been much modified by difference of climate.

We must not infer from the vast number of stags' horns which are found in a fossil state, that there has been an equal number of stags; for, as they come to their full head at five years old, each furnishes fifteen sets of horns, if it lives to complete its twentieth year; and, therefore, making reasonable allowances for casualties, we may say that there are probably ten times as many sets of horns as there have been stags.

But still the numbers have not only been very considerable, but the stag, probably larger than at present, as already mentioned, must have been a very old inhabitant of many parts of Europe, and of these kingdoms among others; and he appears to have shared the fate of some other animals which have now perished as races, in certain catastrophes, the nature of which we do not, of course, very well understand; but from which a portion of stags escaped, perhaps, on account of their fleetness. In the cave of Kirkdale in England, in some parts of France, and in Italy, the remains of the stag are found, blended in one ruin with the bones of the elephant, the rhinoceros, the hippopotamus, the hyæna, and the bear; which is a demonstrative proof that the whole must have at one time been com-habitants of the localities where their bones are found. Hence there arises the curious question, to what circumstances, chemical or otherwise, is it owing that the elephant, the rhinoceros, the hippopotamus, and the hyæna, have perished, while the bear and the stag have remained to the present time?

It will be foreign to our purpose to enter upon the formal discussion of this curious question, which belongs fully as much to geology as to natural history; and for the geological solution of which the data are but scanty. But we may remark in passing that these curious charnel houses, which carry our thoughts to times long gone by, are all, we believe, contained in fresh water deposits; which abundantly shows that no ocean flood could have borne on its tide those animals which we now regard as foreign to the several localities; and as the elephant, the rhinoceros, and the hippopotamus are all semi-aquatic, found always low down—and as the hyæna is a burrowing animal, and neither it, nor any of the other three, is well fitted for flight; while the stag is fleet, and the bear can climb, we can suppose that these two animals could make their escape from a local flood, by which the others were borne to those entombments in which their bones are found. But what was the catastrophe?—So far as we can judge, there has not been one but many; and they do not appear to have been attended by the action of any cause which disturbed the solid strata of the earth, any further than perhaps mechanical laceration of the surface; and, generally speaking, if we search upward along the rivers near which those deposits are accumulated, we might trace something like the empty basin of what has once been a lake, which lake, by the bursting of its barrier, might have produced exactly the same kind of result with which we meet.—But we have to do with living animals, and not with the memorials of those that are dead.

In Britain the stag, which was once so abundant, is now very rare; and the few that are met with in England are objects of curiosity rather than any thing else; and, though royalty still keeps up stag hounds, stag hunting even by these is a most ungallant and even ignoble sport, a sport from which the “merry men” of old would have turned away in most baronely indignation. The deer is carted to the field, hunted to a stand still, and then carried home again; and thus ends the sport—equally unmeaning and unmanly.

In former times it was far otherwise; and nowhere is this most dashing of all exploits in the field described with more vigour or more truth of attention to the other animals incidentally mentioned, than in Scott’s beautiful national poem, “The Lady of the Lake.” We shall quote a few lines of the opening:—

The stag, at eve, had drank his fill,
While danced the moon on Monan’s rill,
And deep his midnight lair had made,
In lone Glenartney’s hazel shade;
But, ere the sun his beacon red
Had kindled on Ben-Voirlich’s head,
The deep-mouthed bloodhounds’ heavy bray,
Resounded up the rocky way,
And faint, from farther distance borne,
The echo of the hoof and horn.—
Yelled on the view, the opening pack,
Roe, glen, and eavern paid them baek.
To many a mingled sound at once
The awaken’d mountain gave response:
A hundred dogs bayed deep and strong,
Clattered a hundred steeds along;
Their peals the merry horns rung out,
A hundred voices joined the shout;
With whoop! and hark! and wild halloo!
No rest Ben-Voirlich’s echoes knew.
Far from the tumult fled the roe;
Close in her covert cower’d the doe;
The falcon from her cairn on high,
Cast on the rout a wondering eye,
Till, far beyond her piercing ken,
The hurricane had swept the glen.

Considered merely as poetry the passage which we have quoted is very beautiful; but Scott had so keen an eye and so warm a heart to every scene and every production of nature, that it was only with him to glance at a subject, and it instantly became enveloped in a flood of light. We have the habit of the stag quaffing the clear stream by moonlight. “The hart by water brooks;” next we have him plunging into the forest for his nocturnal repose. Then at grey dawn we have the whole cavalcade of the hunters to horse; and the bloodhound sent forward to find the slot, and track and start the deer. But for this part of the business we must refer to the article Dog. The hunt hurries forward after the staunch deer finder; but not a hound gives tongue till the game is in view; when the whole open like thunder; and it is hurry scurry, and neck or nothing if the ground is in a state of nature. Nor is the character of the other two species of deer given with less truth; the roe on the mountain top speeds off like the wind to those cliffs where no bloodhound could track him, nor pack run him down. On the other hand the doe, or female of the fallow-deer, a feeble and frightened creature, crouches down among the bushes, as if to escape by her insignificance from that fate from which her limbs are unable to bear her away. Last of all we have the falcon, perched securely on the rock, and equally safe in mountain castle, and her impetuous wing, looking down in utter astonishment, and contempt if you will, at all this coil and clatter among helpless and ignoble creatures, who must be content with walking and running on the humble earth, while she can cleave the air as swiftly as an arrow.

In different parts of the world, as we have already mentioned, the stag varies in size as well as in colour, but its average height is about three feet and a half, and its general colour reddish brown above, and whitish beneath, with some black about the face, and a list of the same down the hind part of the neck and between the shoulders. The greatest known weight of a British stag is that of one which was killed in Aberdeenshire, namely, three hundred and eighteen pounds, exclusively of the entrails, head, and skin. It is alleged that, in Bavaria, the animal frequently exceeds this weight. In Siberia, and some parts of America, it is usually of very large dimensions; whereas in China, Corsica, and some other parts of the world, diminutive varieties are found, which, in bulk, scarcely exceed a dog of ordinary size. Indi-

viduals also occur of a very dark or blackish brown, some of a light or yellowish brown, and some entirely white. The usual number of branches on the horns of a well-grown stag is six or seven, but some have more, and one variety is characterised by the superior amplitude of its horns. In most cases, the males only have horns; and after their sixth year, when they arrive at maturity, they shed them annually in spring, when they seek the most retired places, and feed only during the night. The annual reproduction of these appendages constitutes, in many points of view, one of the most remarkable phenomena of animal physiology. First, it affords a most striking proof of the power of the nutritive senses, and the natural growth which depends on it in warm-blooded animals, since the horn of a stag, which may weigh twenty-five pounds, is completely formed in ten weeks; secondly, it exhibits a singular instance of a limited duration of life in a part of the system, entirely independent of the life of the whole; and thirdly, it manifests a change of calibre in particular vessels; for the branches of the external carotids, which supply the horn with nourishment, are remarkably dilated during its growth, and recover their former area when that process has ceased; fourthly, it bespeaks a peculiar sympathy between the growth of the horns and the generative functions; because castration, or any essential injury of the organs of generation, impedes the increase, alters the form, and interrupts the renewal of the horns.

There are certain technical names given to the stag, according to his age, which are worthy of being noticed. The young, whether male or female, is styled a *calf*, and for a few months there is very little distinction between the sexes. At the age of six months, the *bossets*, or rudimental horns, begin to appear in the male, but they do not advance farther that year than two cylindrical knobs. In the second year they are longer and pointed, in which state they are spikes or dags, and the wearer of them is called a *brocket*. In the third year the horns put out two or three *tynes* or branches, and the deer becomes a *spayed*. The crown, or *surroyal*, appears on the top of the beam the fourth year, and then he is a *staggard*. The fifth year he becomes a *stag*, which is the only year that he technically retains the name of a species; for the sixth year he becomes a *hart*, and so remains for the rest of his life. In the sixth year he is called a *hart of ten*, when he is considered still too young for being legitimate game; but after his seventh year he is said to be *croched*, or *palmed*, or *crowned*; after which he is fair game. The number of snags or tynes in the crown of the horn seems to depend a good deal on the richness of the pasture, and on their having proper shelter and food during the winter. In former times, specimens were found, both in England and in other countries, with more than thirty snags on the crown of each horn; but we believe that half that number is of comparatively rare occurrence.

The female passes through a succession of stages as well as the male, but they are not so important; and, besides, regular sportsmen never make game of the females. The female of the first year is a *calf*, of the second year, a *brocket's sister*; and the third, and ever after, a *hind*.

Stags do not *mew* or shed their horns immediately after pairing, though there is reason to believe that the decay of the horn begins at that period. The

crowned harts are the first to shed theirs, and always the older the earlier. Something depends upon the season and the pasture, but the average time may be reckoned about the end of February. The harts often shed theirs a month or six weeks later, and the younger ones a month or six weeks later still. The technical word for the horns is *attire*; and when these are shed, the animal is said to "lose his attire." In this state he is comparatively defenceless, and retires into the shadiest parts of the cover, or into the most remote or unfrequented parts of the pasture, where there is no cover. He remains there during the summer, and about the month of August the horns are completed; and he clears them of the skin of velvet with which they were covered, by rubbing them against trees or rocks, or against the ground. The hind is in retirement in a different part of the pasture during the same time, where she attends to her calf with truly maternal solicitude, and shows considerable address in drawing off any apparent danger from the place where it is concealed. The young of the former year and the brockets form a third association, but they also retire when they shed their horns.

In the rutting season the harts fight desperately with each other, but it is only when two of the same age come into contact with each other that this occurs, for the weaker always gives place; and indeed there seems to be a provision of nature to prevent these rencontres, for the fury of the rutting season comes upon them in the order of seniority, which is also the order of strength. In their battles their horns often get so entangled, that the two are thereby held together till both perish. The great agitation into which they are thrown at this period completely exhausts them, which is not to be wondered at, when we consider that they abstain almost entirely from food, and run about the pastures "routing" or roaring, as if they were mad. Immediately when the stimulus is over, they withdraw in a state of great exhaustion, and remain quiet, eating a great deal, especially acorns, if they can find them; and this is the reason, probably, why they attain a larger size in oak forests than in forests of pine, or on the open hill; and it may in part account for their superior size in former times both in Britain and on the continent. In England, those noble animals are, as we have already hinted, comparatively few; but the case is different in the mountainous parts of Scotland, especially in the central Grampians, between Athol on the south, and Badenoch and Strathspey. There are a few in the south-western Grampians, and also in the mountains northward of Lochness; but there is nothing which can be considered as a deer-forest in either of those places, or anywhere in Scotland, or, we may add, in Britain, except the forest of Athol, or, more strictly speaking, the forest of Minigag. The eastern part of that forest contains some of the loftiest mountains in Scotland, and it gives rise to various branches of the rivers Dee and Don towards the eastern side, of the Spey towards the north, and of the Tay, more especially the Bruar and the Tilt, towards the south. There are extensive natural forests of pine in the upper glens or valleys of the eastern rivers, but the deer are not quite so abundant there as they are in the south, where the exposure is warmer and the pasture better. Glen Tilt and Glen Bruar, especially the former, are the principal winterings; but

the deer, if all together, have a range of not under less than 100,000 acres of hill, and on this there are certainly not fewer altogether than 7000 or 8000 head, old and young, the greater part of which are the property of the Duke of Athol; and the great hunts, or rather slaughters, most frequently take place in Glen Tilt, though the more laborious operation of "deer-stalking" is pursued in other places. On the great hunts, they are driven by a circuit of people, who bring them to a pass or narrow, where the marksmen are posted, so that they can select and make sure of their victims. This is not a very manly sport, but it is very efficient "pot" hunting; and the nature of the ground renders it impossible to adopt any more sportsman-like mode.

It is understood that, from the care bestowed upon them by all the proprietors, red deer are becoming more numerous on those mountains; and though the hill is quite open, and the keepers are but few, there is comparatively little poaching; and, indeed, it is rendered unnecessary, because the deer are always straying so far out upon the spurs of the hills, that any one who is so inclined may occasionally have a shot; and to attempt shooting deer on the open Grampians, as a matter of profit, is nearly out of the question.

When poaching is attempted, it is generally in the winter, or in the latter part of the autumn, which usually has all the horrors of a very severe winter in those exposed and upland places; and there have been instances in which adventurers, who went to spend the night on the hill for the purpose of obtaining deer illegally, have had the most terrible justice executed upon them by the storm. The snow storms on those mountains nearly rival in violence the "temporales" of the Andes: the snow makes the air as dark as midnight; and the wind drives with the voice of thunder among the crags, and sweeps the waste with the force of hurricanes, so that men are rolled before it like chaff, hurled over some precipice, and lost,—until the crow and the raven point out the place of their bones in the ensuing summer; for the snow in which they are buried in great part preserves their bodies to become food for these dark and dusky-coated scavengers of the desert.

Such is the situation and character of the most extensive forest of red-deer which now occurs in this country. In England there are remains in some of the royal forests, and perhaps in a few other places, but they are comparatively few, and do not stamp the principal character upon the locality as they do on the Grampians.

FALLOW-DEER (*Cervus dama*). This species is smaller, feebler, and more tame and common-place in all its characters than the stag. There are no canine teeth in either sex. The male only has horns, which are round in their section, with two pointed antlers, and the summit palmated lengthways. The colours are variable, but they are in general brown, dappled with white. The horns of the male fallow-deer, or buck, are divergent, terminated above by a flattened longitudinal palm, toothed with what are termed *advancers*; the base of the beam round, with basal and median, or brow and bezantlers, pointing forward. It has no canine teeth, and the nose is terminated by a muzzle. In size it is inferior to the common stag. In summer both sexes have the back, flanks, and thighs, of a fulvous-brown colour, diversified with numerous white spots. In winter these parts are wholly brown; the

buttocks are always white, with a black streak on each side; the tail is longer than in the stag, reaching to the houghs, black above, and white below; a dark line passes along the back; the belly, inside of the limbs, and under the throat, white; the head, neck, and outside of the legs, reddish grey.



Fallow Deer.

The male of the fallow-deer is usually called a buck, the female a doe, and the young a fawn. The buck fawn has no appearance of horns the first year, but they come up in simple snags the second, at which time it is a *pricket*. The third year there are two branches, and the palm begins to be formed on the top of the beam; but it is not properly formed till the fifth year, when the animal becomes a buck of *the first head*, which answers to the stag of the former species. The horns have now attained their principal shape, except on the margins of the beam, where they every year acquire additional snags, which are called *spillers*, or *advancers*, but they continue to increase in size. As is the case with the stag, they drop their horns in the spring, and both that operation and the rutting comes on about two weeks later. The period of gestation in the doe is eight months; she becomes fertile the second year, and ceases to be so about the fifteenth. The fawns, at a dropping, are one, two, or three, according to circumstances.

Fallow deer are gregarious; but the bucks live apart except during the rutting time, and in winter, when most gregarious animals live indiscriminately. Where the herd is large, it is, however, generally divided into packs, each under the guidance of the oldest or most powerful buck. This species is so well known as the common park deer of Britain, that a minute description of it is not necessary. It is not known, and probably never was known in a totally wild state in this country; and this in part accounts for the diversity of colour we meet with. In the south of Europe it grows to a much larger size than with us; and hence it has been supposed that it is native there; but the point is not fully ascertained, and it may be an importation from the west of Asia. In the central countries of Europe, wild ones are few, and there are none to the northward of the Carpathian mountains. But in all parts of Europe, where there are extensive parks, there are fallow deer in a

state of semi-domestication ; and where there is cover in the neighbourhood, they often escape in such numbers as to become an annoyance to the farmers.

The flesh of the fallow deer is understood to be more delicate and juicy than that of either of the wild sorts in this country ; and it is in consequence in high request as a luxury. The animals themselves, though destitute of the grandeur of the stag and the gracefulness of the roebuck, are very ornamental in parks ; and where undisturbed, they are very tame and gentle throughout the greater part of the year, and not nearly so formidable in the rutting season as stags. The sound of their voice is low as compared with that of the others, and it gets the technical name of groaning. Bucks when hunted do not take the country in breadth as the stags do, but run in circles, and very frequently take the water, though they are not such bold swimmers as the stag. The chase of them, both from the grounds they frequent and from their own characters, is not so strikingly effective as that of the stag, but it requires more care, as they are apt to throw out the hounds and leave them at fault.

Though the existing fallow deer appears to be a native of the south, at least of the south of Europe, though certainly not of tropical countries, yet the large deer, of which the remains are found in the fresh water deposits, are usually referred to this species, or at least to one resembling it, on account chiefly of the form of the horns ; and it is a little puzzling that the fallow deer which appears to have a more southerly habitation than the stag, should have palmated horns, approaching more nearly to the character of those of the polar deer than those of the stag do ; but, as is the case with all animals which have been very long in a state of total or partial domestication, and which accompanied men in their migrations from country to country, it is by no means easy to ascertain whether the fallow deer has degenerated in size from the fossil specimens, or whether its horns may not have altered their character from being simply forked as most of those of the deer in warm countries are, to that palmated form of the upper parts of the beams which they now display.

The ROEBUCK (*Cervus capreolus*). This is the most light and handsome of all our deer ; and in some respects it approaches the antelopes, the ancients giving it and some of the species of that genus indiscriminately the name of *Dorcas*, that is "bright eye ;" no lachrymal sinuses, scarcely any tail, the colour a greyish yellow, varying more to reddish or brownish, but always with a large white disc on the buttocks. The horns are rather small and cylindrical, with a small antler on the middle of the beam pointing forward, and a second one higher up and turned to the rear. The roebuck is pretty generally distributed, being found in all the temperate parts of Europe and Asia, and even it is said in India, though there it has been confounded with some of the Indian species which resemble it a good deal in the forms of their horns. This is the smallest species in Europe, not exceeding four feet in length, and standing about two feet high at the shoulders. There are coloured varieties, one very red, and another yellowish brown, and a third nearly black ; but they all have the characteristic white disc, at least in the winter, and the tail is never more than an inch in length. Their summer and winter clothing differ a little both in colour and in texture. In winter the fur is completely soft

and tinged with grey on the neck and head, and the disc is much less conspicuous ; but in winter the hair thickens and hardens, and the colour deepens, especially on the upper part.

The manners of the roebuck are different from those of the species hitherto described. They are not gregarious, and therefore do not make the same appearance in proportion to their number as the deer. The male is also monogamous, and remains attached to one female for life, the two keeping company, or at least being near to each other all the year round, and the rutting season not being accompanied with that violent excitement which takes place in the others, more especially in the stag.

The period of gestation is also different, and so is the time of shedding the horns in the male. Rutting time is in the beginning of November, and the female goes little more than five months, while the fallow deer goes eight months, and the hind a little more. The pairing is thus about two months later than in the others, and the fawns are dropped about two weeks earlier. The male also sheds his horns soon after the rutting time, and acquires the new ones during the winter, so that he is in his apparel for a much longer period of the year than either the hart or the fallow buck.

The doe drops two fawns, for which purpose she retires into the closest cover that she can obtain, but at the end of about two weeks she makes her appearance with them in company ; but she hides them if danger appears, and shows considerable address in enticing enemies away from the place of their concealment. They are generally, if not invariably, a male and female, which continue with their parents during the summer ; but previous to the rutting time they are driven off to shift for themselves, and to keep company with each other for life, which is from about twelve to fifteen years, if no casualties occur ; but as roebucks prefer the open hill to the shelter of the forest, many of them perish in severe winters.

They are much more destructive to young plantations than either the stag or the fallow deer, as they prefer the tender twigs and buds of these to grass ; but they are lively and vigorous creatures ; and few sights are finer than that of a roebuck bounding among bushes, or up a hill side among tall heather. This plant is often as tall as himself, so that when he alights he is concealed, but at every bound he rises to some height clear of it, and puts one in mind of what is stated of the antelopes in the coppices of Southern Africa. The roebuck leaves a strong scent ; and therefore he is more easily found than the stag, where stags are not numerous ; but he is not more easily caught. As the stag runs out, he is sure to fatigue himself ; and though he recovers if he can reach the water, and makes a formidable resistance when he stands at bay, yet, if the dogs are staunch, and the ground practicable, he is almost sure to be taken ; the roebuck on the other hand shows artifice : he dashes off at first, but if pursued he doubles, bounds sideways to some cover with immense leaps, and with the velocity of a bird, and couches down till the chase pass him, and then, bounding from his cover, he is off in another direction. The same roebuck has been known to be hunted through several counties ; and of these one is mentioned by the late Mr. Bewick, of Newcastle. It had been hunted out of Scotland through Cumberland and various parts of the north of England, and at last took shelter in the copses on

the Tyne ; there it was frequently seen, and as frequently hunted. But no dogs could come up with it in speed ; and its arts were equal to its agility, as it swam the river, or in some other way escaped. The chasing was continued during the sojourn of a very severe winter ; and upon one occasion it crossed on the ice, and by so doing was so much strained, that it was easily taken alive. After being kept for some weeks in the house it was again turned loose, but all its enterprise and all its cunning appeared to have left it ; for after being chased only a little way it lay down in the middle of a brook, and was killed by the dogs. This anecdote shows that the peculiarly elastic character of the roebuck is quite incompatible with domestication. It is also very difficult to confine this species within enclosures, in consequence of the height to which it can leap ; and as its flesh is not considered quite so good as that of the others, and farther, as there is not so much of it, it is left in a great measure to its native freedom on the hills. It should seem that the roebuck by being less excited in the rutting season than the others does not come into such high condition preparatory to that season.

In England, roebucks are now very rare ; and as there is cover for them in most of the places where they might be looked for, they are not easily found. In the Scottish mountains, however, they are more abundant, though scattered, and rarely seen more than one at a place at the same time. They are not met with in exactly the same places as the red deer, but rather where there is an admixture of hill and roek and copse. They are also, at certain seasons of the year, met with further down than the red deer generally are, but they do not hesitate to take an occasional dash into the inhabited parts of the country when the winter is very severe on the hills ; but on these occasions they generally have all their arts about them ; so that it is but a passing sight which one can obtain. It is also more difficult to get a shot at a roebuck than at a red deer. In Scotland they are found as far north as Sutherland and Caithness ; but their chief haunts are in the neighbourhood of those places which have been described as abounding most with red deer ; only from the peculiarity of their manners, and the fact of their feeding in the copse and on the twigs, rather than browsing the herbage, they are not often seen, to which their habit of lying close till the danger be passed, contributes still farther.

There is no account of the horns of the roebuck being met with in the same accumulations as those of the other deer in this country ; but they have been found in some parts of France, though it is said that there are some peculiarities in the fossil remains which are not found in the living animals ; and thus, though there is a similarity established, there is not a perfect identity, so as to warrant us to conclude that the roebuck of our times existed and inhabited at the same period and in the same country with those now extinct animals the *Paleotherium* and the *Mastodon*, whose remains are found in the same accumulation of peat, near the river Somme in France.

Such is a short account of the three species of deer which are met with in the wilds or in the parks of our own country ; and they are the ones whose manners we have the best access to study.

THE AHU, or Tartarian roebuck—*Cervus pygargus*. This is the roebuck of the middle latitudes of Asia, and of part also of the east of Europe. It is a larger animal than our roebuck, and differs from it in having

the hair longer, and the horns more developed, and more furrowed and tuberculated in their basal parts. It is very generally distributed over the margins of the waste, from the mountains which divide Persia from the central countries of Asia, to some distance into Siberia ; but it is not found in those parts of that extensive region which have a decidedly polar climate. In the summer season it keeps to the mountains, among the cliffs of which it bounds with great vigour ; but in the winter it descends to the plains.

Like the roebuck it has no lachrymal sinuses, and the tail is still more deficient, being nothing more than a mere tubercle. The colour on the back is brown in summer, and that on the under part is yellowish. On the hinder part of the thighs and around the rudimentary tail, there is a disc of white, larger and more conspicuous than in that of the roebuck ; and this mark is constant amid all the varieties of colour in the individuals, and all the changes from age or climate ; and the old and young, and also the summer and winter appearances are so different, that animals in these states have been described as distinct species. A space round the nose and sides of the under lip is black, but the lips themselves are white ; and those characters also remain constant.

The hair of this species is exceedingly thick, more so, perhaps, than that of any other. In summer it is stiff and erect, allowing the air to reach the skin, notwithstanding the great thickness of the covering. In winter it gets shaggy, and falls more closely on the body, forming a very warm covering. It does not appear that at this season it gets any of that long intermixture in its coat to which the name of "snow hair" may be applied without much impropriety ; but its general coat becomes dry and bleached to a hoary colour at the points, which answers nearly the same purpose.

In all the field animals of central Asia, from the Himalaya northward, there is some provision of this kind ; and the great change of seasons to which this part of the world is subject, is at once the necessity and in all probability the cause of this provision. In summer, the heat is excessive ; and the plains are completely burnt up, so as to wear the aspect of vast floors of indurated clay ; and at that season there is no rain except on the mountains ; and as the last plants upon the margin of the desert, or in that kind of shelter which makes an incipient desert of the whole country, are always of a saline nature, the ground is covered with saline incrustations. It is at this season that such animals betake themselves to the mountains, while the wandering horde of Tartars with their cattle, move farther to the north, and reach the lower parts of the plains or *steppes*, where there is still some moisture to be found.

In winter the cold is as proportionably severe as the heat is ardent in summer ; for in plains the elevation of which is not great, and which lie on the same parallel of latitude with the south of Italy, and the centre of Spain, where snow is rarely seen upon the plains, and where there is very seldom ice upon even the shallow pools, the rivers are so completely frozen over, as to afford pontage to the inhabitants.

So great a difference between the summer and the winter naturally produces a corresponding difference in those animals which, like the alu, are freely exposed to the weather all the year round ; and this climatal difference is quite sufficient to account for all the external differences which are traceable between

this roebuck of central Asia, and the roebuck of Europe. As we are not very intimately informed on the subject of the natural history of this part of the world, it has not been ascertained with certainty that the manners of the animal under notice correspond exactly with those of the roebuck of the west; but the structural resemblance, we may almost say identity, is so great as to leave little doubt upon the point. It is probable that this animal is found over the greater part of the high lands in Asia, and that it is modified in its coat in different parts there to as great an extent as the difference between it, as described in the south of Siberia, and our roebuck; and what gives more probability to the supposition of its being but one species from India to Britain, is the fact that in the milder climate of India, there is nearly the same deviation from the Tartarian type as in the milder climate of Europe. Our roebuck is smaller than the Tartarian, shorter and smoother in its coat, and with the horns less developed. The Indian variety is described as being still smaller than ours, more smooth in its coat, and with the horns less developed. These circumstances would lead us to infer that the roebuck is more generally distributed over the eastern continent than any other of the larger mammalia which remain in a state of nature. There is still, however, a good deal to be done in order to trace the connexion between the different localities in which it is found, and to mark the gradation by which the characters of the one locality run into those of the other. But these points are not impossible, for they only require observation; and as it is highly probable that lines of communication may soon be opened up through central Asia, we shall not much longer remain in such deep ignorance as we are at present respecting that portion of the country which may be said to connect the four distinct characters of land and climate of which Asia is composed. Siberia sloping toward the northern sea, China to the eastern, India and Persia to the southern, and the central countries of Asia toward the great salt-lake of the Caspian. All these four are very different in their different characters, and in their vegetable productions; and therefore they must produce corresponding modifications in the characters of animals; and if we could once see clearly how one species, such as the roebuck, common to the whole, has been modified by each, we should be furnished with a key to much of their natural history, the knowledge of which we never can obtain by local and individual observation, however assiduous and however accurate. Nor would the information be confined to the present time only; for as it is well ascertained that the roebuck has inhabited even the west of Europe along with some of the lost animals, and as the fossil horns resemble those of the Asiatic more than the modern roebuck of Europe, this species, well made out, would be at least one means of carrying our knowledge backward to the time when they existed.

The NEPAL STAG—*Cervus Willichii*. This species is found in the upper valleys of the Himalaya, and partakes partly of the characters of the common stag, and partly of those of the roebuck; but more of the former. The horns are circular in their section, each is furnished with two brow antlers turning upwards, which with an additional snag higher up the beam, form a sort of bifurcation. The beam rises with a contrary flexure, bent backwards, and then slightly forwards. The size of the full-grown animal is large; the colour

on the upper part yellowish brown; lachrymal sinuses large; the ear short and broad, the tail very short, surrounded with a very large white disk. The legs fawn colour, the hoofs black, very fine in their texture, and sharp pointed, resembling those of the mountain antelopes. The history of this species, its habits, the change of its colour, and the texture of its fur with age or with seasons are, however, very imperfectly known. Its most remarkable external character is the position of the disc, which is more above the tail than below it, whereas the contrary is the case in most of the other species.

In the south of Asia and the Asiatic isles, there are two distinct groups of the genus *Cervus*, which differ in some respects from the deer of Europe, and the different members, whether we are to consider them as species or as varieties, which compose each group, have certain characters in common which enable us to generalise and thereby shorten, at least, a part of the descriptions of them. As these are known only in Asia, at least, as native animals (for some have been imported into Europe in the living state), we can describe them only by their names as known to naturalists. The one group is styled *Rusa* and the other *Axis*, which we shall shortly notice in succession.

RUSA. The general characters of this group are: the horns round, with a brow antler and a single snag near the tip, but without any bas-antler or branch on the middle; they have a broad muzzle, and large lachrymal sinuses. The males have canine teeth, and rugged manes; the tail is also longer than in any of the European deer; and some of them at least are of larger size. They are the upland or woodland deer of India, and the larger islands of the East; and in their manners they in general more resemble the stag than any other of our species of deer. There are several species of them named in the books; but some of them are known only as museum specimens. It is certain, however, that the animals are very plentiful in the tangled and unfrequented parts both of India and of the islands. Indeed, it is probable that some of the species may inhabit the southern side of the mountains considerably to the westward; for one is mentioned by Aristotle, of the size of a stag, and with a mane on the withers, and a horn resembling the roebucks.

The GREAT RUSA—*Cervus hippelaphus*. This is one of the species the habitat of which is not very well known, though it is probable that it exists in many parts of continental India; but the specimens which have appeared in Europe have been obtained from the islands, chiefly from Java. The hair is coarse and hard; and, after the first year, that on the throat, cheeks, and neck, is long and shaggy, the latter forming an erectile mane. In summer the colour is yellowish, and the disc on the buttocks nearly obliterated, but in winter the colour on the upper part becomes gray-brown, and the disc becomes more conspicuous. Different specimens have, however, varied so much in their colours, as well as their size, that the species is not very well made out.

The SAMVER OF BENGAL—*Cervus Aristotelis*. This species is much better known than the former, being met with in many parts of India, especially in the valley of the Ganges. Its characteristic distinction taken from the horns, is that of having the branch or second antler very far up upon the beam, and turned to the rear, instead of forming a fork with the tip of the beam, as in most others of the group.

The burr of the horn is very broad and pearly; the first antler is cylinder-shaped, strong and straight, and stands nearly vertically upon it, measuring about ten inches in length; the beam bends from the back of it obliquely outwards, and to the rear, and with a sweep turns its point backwards; near the summit, or at more than two-thirds of its length, is the second posterior and internal branch, short and pointing upwards. In the British Museum there is a specimen measuring about twenty-three inches, which is very rugous and robust. The horns stand upon a broad and short pedicle; the face is straight, the nose pointed, the muzzle small, and the suborbital opening is very considerable. The ears are broad, with white hairs standing up around the orifice; the tail is black, reaching half way down the ham, and is well furnished with hair. The throat and neck are covered with long coarse dark brown-grey hair, reaching partially over the shoulders, susceptible of being raised like a lion's mane, when the animal is excited. The shoulders, head, back, rump, and buttocks, are dark-brown in summer, and almost black in winter; outside of the ears sepia; the belly whitish, as also a ring round the nostrils and mouth, separated from the brown by a deeper shade, which spreads up the face; the inside of the limbs and legs fawn colour, darker over the knees down the front; the breast is black. The male is nearly the size of the elk, and indeed is so named in India by the British sportsmen. They represent him as being excessively strong and vicious. Some of them, on a shooting expedition, had crossed an arm of the Jumna to a woody island in quest of game;—they were on the back of an elephant, and entering the jungle suddenly roused an old male of this species. On seeing the elephant he started up with a long shrill pipe or whistle, which caused others to rise and dart into cover, while he stood at bay with his bristly mane on end, in a most threatening attitude: but before the sportsmen could prepare proper shot, he wheeled round and dashed through the underwood with the facility of a rhinoceros. Captain Williamson evidently met the same species. He describes the stag as arriving at the size of a Lincolnshire cart-horse, fifteen or sixteen hands high, shining black, with tanned points (of the hair?) One of these, he says, heads a score of females, who are of a mouse colour. He likewise calls it an elk, and adds, that they reside in the Prauss jungles. But though this species gets the name of the elk, there is no resemblance between them, farther than the generic character. This is decidedly a species of the warmer climates; and though we are but little acquainted with its habits in wild nature, it does not appear to be so social as the elk; indeed, the deer of warm countries do not in general appear to congregate in such numbers as those of temperate and polar climates.

MALAY RUSA—*Cervus equinus*. This is also a large species; and though the specimens hitherto brought to Europe have been obtained from the Sunda Islands, there is every reason to believe that it inhabits the Malay Peninsula, and probably also some parts of India. When full grown, it is described as being of the size of a horse, with the horns tapering, and the second snag, which is turned to the rear, very small. The horns are of a very bright reddish brown; both sexes have canine teeth; and the frontal bone is much flatter than in most species of deer. The colour is greyish brown, paler on the under part; rust colour on the haunches, and the tail; the insides of the legs

whitish, the muzzle black, and the chin white. The following is Hamilton Smith's description of a specimen exhibited some years ago at Exeter Change.—“The animal was then about two years old, and his horns were simple, or in the brocket state; the next year its new horns showed the bifurcation of the summit, to be as in the Black Rusa of Bengal; that is near the summit on the internal posterior side. It was then four feet, or something more, at the shoulder; and still higher at the croup; its eyes were large, dark, and mild: the suborbital slit opened at pleasure, and was remarkably expanded when it drank, with a perceptible action of the air passing in and out as before noticed. The ears, broad and pointed, were nearly naked within, and whitish-grey without, the face, shoulders, back, and thighs were of a dark brown-grey; the hair rough and bristly on the neck and throat. This colour was darker, and the hair very long, especially the second year, when the crest or mane on the neck and throat hung very heavy and thick; the breast and belly were of a dark ash, almost black. A considerable disk of a clear rusty, or orange, colour, expanded over the buttocks, lined the inferior side of the tail, and was separated by a black line from the grey of the thighs. The tail, about a foot in length, was black above; the joints of the legs, the inside of the thighs, and their anterior side were yellowish dun, and the legs from the joints downwards buff; the chin was white, with a black spot at the corner of the mouth, on the lower lip, and a bar of the same colour above the nostrils, which were placed on a black muzzle; the cheeks and space round the eyes were buff, passing to grey.”

The horns are of a dark colour, rugous, robust, but shorter and less curved than in the *Hippelaphus*; the anterior antler, and posterior snag, are both short and obtuse, but from the size of the first, or brocket horns, of the animal being near eight inches long, it is presumed that they become, if not much prolonged, at least very bulky: his second horns were about fourteen inches. This species resembles the Bengal Rusa in many particulars: both have the forehead flat, and the face straight; the muzzle small, with spots of black on the under lip, and a ring round the nose; the ears naked inside; the horns short, stout, and similarly formed; the same mane and dark breast. In fact, the only obvious differences are the presence of a disk on the buttocks of the present, which does not appear on the former, and that of dimensions; but even in this particular there can be no great disparity. It may be, therefore, that ultimately these two will be marked as only varieties of one species.

There are some other species or varieties described as inhabiting the Malay peninsula, or the adjacent isles; but it is by no means unlikely that some of them are the females of the species now described: and, indeed, there is some reason to suspect that all the Rusas are merely climatal varieties of one very widely distributed species, which may be called the stag of South-Eastern Asia, or the Indian stag; we shall, however, mention two others, which differ considerably from those which have been enumerated, and which are the most remote from continental Asia in their localities.

THE MARIANA RUSA—*Cervus Marianus*. This species inhabits the group of the Mariana or Ladrone islands, which lie between twelve and twenty degrees north latitude, and a hundred and forty-four and a hundred and forty-eight east longitude. There is every

reason to believe that it is not originally a native of those islands, but has been imported from the continent of Asia, probably from China. A specimen was brought to Paris, by Quoy and Gaimard, in Freycinet's voyage of discovery, of which the following is a description :—" It is more robust, but not much taller than the roebuck, with round divergent horns standing on a low pedicle, having two antlers, the basal nearly vertical, and at its junction with the beam a small process, not unlike a trilobed tooth ; the other is posterior and internal, and compared with the size of the head, the horns are large and heavy, being about thirteen inches long ; their colour is ashy, and they are extremely rugged. Between the horns the skull has a longitudinal eminence, and before the orbits, near the base of the nose, are two longitudinal convexities, very remarkable, and the species is destitute of canines, by which character it approaches to the true axis ; the face is almost black, with a streak running down from the horns, between the eyes, to the nose ; the muzzle small and black, and the colour of the whole body dark brown, slightly mixed with grey, at least such are the colours now discernible, the specimen being in a bad state of preservation ; the tail is about four inches long, and black. A fawn brought from the same island in the above museum is fulvous-brown, without spots ; the throat is whitish ; a white spot at the end of the lower jaw, and one at the base of the ear. The inside and anterior border of the thighs and buttocks are white, and the legs buff." This species, like most of those of the islands, is described as being very tame and gentle in its manners, which gives additional ground for supposing that it is not an aboriginal animal, but has been carried to the islands from continental Asia.

RUSA OF TIMOR—*Cervus Peronii*. Only the head, we believe, of this species has been brought to Europe ; and from the little acquaintance that we have of the interior of the island of Timor, nothing is known of its habits in its native country. It is understood to be smaller than any of the rest of the group, dark coloured, with slender horns, and the second snag forming a more regular fork with the tip than in the other species of the group. This is the most southerly inhabiting deer in all the eastern continent or its islands ; for the next land which we meet with to the south of Timor is New Holland, in which there are no deer, except such as may have been very recently imported by the colonists.

AXIS. The animals of this group stand nearly in the same relation to the fallow-deer of Europe, as the ruses do to the stag. They are smaller in size, and less vigorous in structure ; they have no canine teeth, and their skins are, generally speaking, dappled with white spots. Generally speaking, they inhabit lower down than the deer formerly described.

THE SPOTTED AXIS—*Cervus Axis*. The chief distinction between this species and our fallow-deer is in the form of the horns, which are round in their section through and without any palm. The horns stand nearly vertical, only with a slight bend forward, and the points inclined towards each other. They have a basal antler pointed forwards, and another on the middle of the beam turned backwards ; the muzzle is black, and there are no lachrymal sinuses. There is, indeed, so much resemblance between this species and fallow-deer that when their horns are shed, it is difficult to distinguish the one from the other. The chief marking colour is in the dorsal line, and the disk on

the buttocks. The dorsal line in the axis is very deep-brown, and marked with white spots, while that on the fallow-deer is paler, and has the spots only on the margin. The disk in the fallow-deer is white, that on the axis is yellowish. The two sexes are also more equal in size than the fallow-deer, the female being larger than the doe, and the male not larger than the buck. There are, however, considerable varieties both in size and in colour.



Axis Deer.

These deer are very plentiful in the lower districts of India, where they inhabit the margins of the jungles ; they are known by the general name of hog-deer, and are much prized by the sportsmen of the east. We believe they are seldom met with in the countries above the Ghauts, or passes of the mountains, as the large deer are seldom met with below ; and, indeed, in all their characters, and in all their habits, they correspond so much with fallow-deer that, notwithstanding the different form of the horns, it is difficult to refrain from considering them as the same species ; and, perhaps, as the parent stock which has supplied the fallow-deer to the western world. Several varieties have been described, but they appear more accidental than otherwise, so that it is unnecessary to mention them particularly.

There is still another group of deer, belonging to the south-east of Asia and the Oriental Islands, which have very peculiar characters, and which are decidedly distinct from any of the rest. Their most remarkable characters are, that the males have the horns upon peduncles, which can be traced upon prominent ridges down the forehead almost to the nose and canine teeth in the upper jaw, which are so long that they protrude beyond the lips. They have also very deep lachrymal sinuses. The tongue is very long, and they can protrude it upwards as far as the eyelids. They appear to be intermediate between the deer, properly so called, and the musks ; and it is doubtful whether they shed their horns seasonally like the other deer. They have been brought chiefly from the Sunda and Philippine islands ; but there is also a species in Nepál. There is some difficulty about the different species, but there seems no doubt that several of them are distinct, and those which are obtained from the Philippine islands, from the Sunda

islands, and from Nepál, are all different from each other. They are elegantly formed creatures, and, notwithstanding their produced canine teeth, they have a very mild and gentle aspect. The following is the description of the Sumatra species or variety:—The body is compact; the legs remarkably fine and slender; the muzzle is rather broad; and the canines assume the form of inverted tusks, sharp at their points, turned towards the animal, and outwards. Two rib-like eminences ascend from above the nose over the eyes, and, elevating themselves from the head, in the form of slender pedestals, to the height of two and a half inches, terminate in a flattened summit. Upon these the horns are placed, about three or four inches long, forked at top, with the points turned inwards, and with a small branch at the base pointing forwards; between the ribs the skin of the face is doubled into a fold, which has the appearance of a third or central rib; the fur is fine and close, of a greyish brown, paler beneath; the breast, inside and anterior face of the thighs, are whitish; the tail is short, dark above and white below.

The Malay name of this animal is *Kijang*, or *Muntjak*, the latter of which has been adopted as the specific distinction. They are understood to live in pairs, in the same manner as the roebuck. Several varieties of them have been imported from Sumatra, from the Philippines, and from other parts of the Indian Archipelago, the history of which is not very clearly made out: but the following is the description of one from the Philippine islands:—"The peduncles and the horns are about one-fourth the length of the head, and thicker than those of the kijang, and the ridges which terminate in them extend down only as far as the eyes. The rest of the face is flat, with the forehead slightly arched; there is a dark streak on the anterior base of the pedicles, and between them the hair is black, forming a spot with the point downwards, and leaves a crescent of a dirty buff between them; this colour spreads round the orbits and on the cheeks; the lachrymal sinus is dark; the ears rather short and obtuse, whitish within, dull buff outside; the colour of the coat is wholly brown sepia-grey, clearer on the throat, and darkest on the neck and eyes; the tail is three inches long, black above and white beneath." There are several museum specimens from the Oriental Islands, which appear to differ from each other; but as some of them are only fragments, their characters are not fully made out. There is one, however, of which a pretty distinct account is given:—

THE NEPAL MUNTJAK, or Musk-deer of Nepál—*Cervus moschatus*. In the Oriental Collections for January, &c. 1798, vol. ii., Sir William Ousley figures an animal, under the name of Musk-deer of Nepal, from a drawing executed by a native artist, with the following dimensions, communicated by Colonel Ironside:—Length, from between the ears to tail, two feet four inches; height, two feet; length of head, seven inches; of the tail, six inches and three quarters; of the tusks, two inches and one-eighth; the hair bristly and thick, two inches long. By the illuminated plate, the animal must be entirely dull fawn colour, with the superior part of the tail alone dark; the horns, placed upon high pedicles, are dark, simple, without branches, and pointing to the rear; the limbs are very slender; the spurious hoofs small; the neck rather short. The habitat and character of the hair render it probable that it is a distinct species;

and although no reason is assigned for the name of musk-deer, that being the designation of the natives, render it probable that it is impregnated with a musky smell. Altogether, these are rather singular animals. The length of the canine teeth is a very remarkable character, and one which is somewhat puzzling; as, along with this armature of the mouth, the animals are remarkable for the gentleness of their manners. The fact of the horns being shed only once, or at most twice during the life of the animal; and if this is fully established, it will be sufficient ground for taking these animals out of the genus *Cervus*, and establishing them into one entirely peculiar; but, in the meantime, we want information respecting them. There is no doubt, however, that they have many peculiarities; and as they are found in so many parts of the East, and with different characters in the different localities, they may perhaps, when better understood, throw additional light on the zoology of the regions to which they belong. It is understood that they are gregarious, and very timid and gentle in their manners; that they do not live in large herds, but in small packs or families in the woods; and though they unquestionably partake more of the characters of the deer than of those of any other genus, they are undoubtedly very peculiar, and there are no animals in the east the more perfect history of which would be more desirable. This is the more to be desired, from the fact, that there does not appear to be anything analogous to them, either living or fossil, in any other part of the world. There are many points, however, in their structural history of which we are in a great measure ignorant, and which will require to be cleared up in a satisfactory manner before we can confidently decide whether they are to remain as part of the genus *Cervus*, or whether they ought to form an entirely new genus. The zeal and assiduity with which the natural history of the East is now prosecuted cannot leave this point long unsettled.

The species which we have now noticed comprise all the deer of the eastern hemisphere; and if we imagine a straight line drawn from Spain to the Island of Timor, all the countries in the hemisphere which lie to the north-east of this line are inhabited by deer, though partially mixed with antelopes in several of the middle regions, while all to the south-west is the proper country of the antelopes. It is true that deer thrive well in the Mauritius and the Isle of France, but they are imported animals there; and we believe there were no ruminantia in those islands when first discovered.

III. DEER OF AMERICA.

It only remains now to give a short notice of those species of deer which are found in the American continent, and not in any other part of the world, and we shall take them in order from north to south, though some of them inhabit nearly the same regions. There is, however, some confusion in these species, arising from differences of colour, having been perhaps incautiously made specific.

THE WAPITI—*Cervus strongyloceros*. This species is now well known in Britain, from living specimens being kept in the different zoological gardens; but it is probable that another described species should be referred to this one, namely, the Canadian Stag (*Cervus Canadensis*), of which there are also varieties mentioned. We shall quote Hamilton Smith's description of the Wapiti as being the best, both on

account of the describer, and of the fact (a very important one), of his having seen the animal in its native locality:—"Our wapiti resembles the common stag in nearly all his proportions, but his size is far superior, being at the shoulder from four feet four to four feet eight inches, the superiority of bulk appearing chiefly in the magnitude of the body. The hind is similar to the stag, with inferior proportions; the colour of both in the summer season is fulvous brown on the back; a black spot on each side of the corners of the mouth descends on the under lip, round the eye brown, and down the face darker; the neck also is darker than the body, being mixed with a purplish brown tint on those parts; the limbs are anteriorly dark, and lighter from behind; under the horns long hairs form a sort of dewlap, also darker in colour; the buttocks and tail are pale fawn colour, separated from the brown of the thigh by a dark streak; the tail is short, but varies from two to four inches in length; the suborbital sinus is long, open and naked next the eye; the ears are long, lined with white hair within, and dark coloured externally; inside of the limbs and on the belly the hair is close and buff-coloured.

"The specimens seen in Europe appear somewhat different in their colours from those in America, no doubt in consequence of confinement and grooming. The long hair of the throat, and also much of that on the ridge of the neck and sides, dropping off. This description, derived from comparing several living specimens both in Europe and America, is the summer habit. One individual in his winter fur was of a chocolate brown red, mixed with grey, all over the body; the neck, thickly furnished with long hair, and the woolly soft fur on the forehead, were sepia-brown; the chin pure white, and the buttocks and tail also nearly white.

"Comparing this account with our notes taken on the spot during a winter in America, we find a stag reported to have been brought from the Missouri, but which in reality might have been taken in the northern districts of the state of New York, in the vicinity of the great lakes. He was three years old, four feet six inches high at the shoulder; the nose and legs sepia-black, turning on the neck and back to dun brown; the croup and tail nearly white; the body short and thick like the trunk of an ass; the legs shaped as in a calf, very perpendicular on the buttocks, with appearance of callosities on the knees; the croup somewhat more elevated than the withers; the neck much arched and adorned with some long hair, the full expansion of that part not taking place till the fifth year; the muzzle broad and black; the eyes dark, and the aspect mild; the horns were greatly deformed. On the 17th of February, another sketch was taken of the same animal, his horns were beginning to shoot anew, the cicatrix of the former not quite healed, and their form resembling a flattened globe; his face was covered with woolly hair, extremely thick; on the side of the hinder legs, near the true heel, a gland imbedded in hair secreted an unctuous fluid, which seemed to cause uneasiness, and we were informed that while the horns are expanding the animal frequently rubs the points of the antlers against them; the colour of his fur was a sepia-grey, extremely shaggy. This individual was, according to Mr. Skudder, exactly similar to the specimen shot on Long Island, and might therefore be considered the Canadian variety; and the drawing, compared with

the stuffed specimen in Paris, if it be not the identical animal, closely resembles it.

"The horns of this species acquire a surprising development, expanding with such rapidity that at one period their growth exceeds an inch and a half per day. In the Long Island specimen, of six antlers each measured above three feet in length, and the bur and beam were exceedingly large, but in some individuals they are asserted to exceed six feet. One specimen, of which we have a drawing, shows them nearly five feet long. The base and tertian, or brow and royal antlers, are invariably the longest in both the varieties. These seem to be instruments of use, for with them, when a small dead pine, or a bar of a split fence sixteen or eighteen feet long, lies in their way, they will lift and toss it clear over their backs.

"In England, where they have propagated, it appears that some care is required for their preservation, since to an alleged neglect of this kind is ascribed the loss of no less than twelve head of the herd belonging to the king. In Canada they feed on some buds of coniferous trees and grass, and in summer on aquatic plants, which they seek under water while sheltering themselves in that element from the bites of flies. It was in the act of feeding in this manner that we had a view of the Canadian stag. We were in a canoe ascending the Chaudiere, at a point where the river bends suddenly on opening into a small lake. A hunter among us made a warning sign for silence and pointed a-head, but nothing appeared on the surface of the water; the bateau men, however, understood the sign, and grasped their muskets, but with so much precipitation and noise as to alarm the game, which now again put his head above water, and seeing the canoe sprang forward towards the bank with his mouth full of weeds. At this instant he was fired at, but he gained the shore very near us, and dashed with elevated antlers into cover, as was thought, unhurt; he appeared quite black, with large expanded horns, but no further observations could be made. We were then informed that at this period (August) they are often killed while feeding under water, but the canoe must be so placed as to glide with the current and without noise close to them; the game only raising its head to breathe from time to time, takes no notice of an object which appears motionless.

"On the banks of the Missouri they are said to live in small families of ten or twelve individuals, headed by an old male, who is reported to be monogamous; the rest beside the hind being calves and semi-adults. The females are capable of procreating very early, one born in England having produced a calf at eighteen months old. This circumstance militates against the opinion of the Indians respecting their longevity. The males do not bellow, but when they are alarmed or excited send forth a loud piercing whistle, to all appearance from the suborbital slit. They mew their horns in the latter days of February or during March, and require little more than three months to recover them, notwithstanding their enormous size."—*Animal Kingdom*, vol. iv. p. 98, &c.

From the character of its native country, there is little doubt that the wapiti might be added to the ornamental animals of this country; and though it wants the majesty of the stag, the beauty of the roe, and the softness of the fallow deer, yet its size and the grandeur of its apparel would render it a highly interesting variety in the more extensive parks.

NORTH-WESTERN STAG—*Cervus occidentalis*. It is

at least probable that, though the wapiti varies in colour from black to brown, there is another stag, more of a mountaineer, in North America, to the westward of the great central valley; and though this species displays very considerable variety in the extent of its range, it is probable that it occurs in the Canadian mountains, and is the animal described as the Canadian stag, more uniformly red in the colour, and more light in its make than the wapiti. It has been seen at different parts of the west coast, and perhaps ranges along the Stony Mountains as far as California. Its horns are smaller than those of the wapiti; and it has a character somewhat peculiar, namely, that the bezantler, or second on the beam, is longer than the brow antler. The horns are about three feet from burr to tip, very much furrowed and pearly; the brow antler turned downwards over the face, the bezantler forwards or upwards; and the royal, or tip of the horn, consisting of snags from a common centre, as in the stag. There are varieties of colour, but the following is about the average: face dark brown, cheeks and space round the eyes buff, chin and inside of the limbs white, muzzle broad and black, lachrymal sinuses long, ears long, dark outside but inside and margin white, neck, back, flank and hams brown, legs ochre-yellow, tail in some of the varieties long, in others short. Additional information is wanted, however, in order to determine whether there are several species or only one diversified by climate.

THE VIRGINIAN DEER—*Cervus Virginianus*. This is what is usually styled the fallow deer of America. It is a very light and handsome species. It stands about three feet three inches in height at the shoulder. The horns are inclined forwards, with their points turned toward each other, so that they are not further apart than the bases. The burr is small, and near it on the inner side of the beam rises a short antler inclining inwards. The first horn is a simple pricket. The second has a forked summit, and then in the fifth year there are two or three snags on the posterior or curved part of the beam. On mature age the upper part of the beam becomes palmated, and the snags become double pointed; the burr also extends, and so does the brow antler, but the horns are subject to very considerable varieties. In summer, the hair of both sexes is of a bright yellow cinnamon colour, which changes to a fine brownish grey during the winter, the hairs of that season being annulated with brown and buff. The belly, inside of the thighs, the internal face of the fore legs, above the knees, and the posterior, inner border of the buttocks, are white; the throat, breast, and under part of the tail, of the same colour; the upper part of the tail dark, and the legs fawn colour; the ears are long and pointed, outside of a brown grey, inside well lined with white hair; the forehead, face, and cheeks, brown with a slight mixture of grey; round the eyes, lips, and chin, fawn colour; the muzzle small and black, no spot on the corner of the mouth, but the winter hair of the belly and under part of tail long and silky, and the bristles on the inside of the hinder joint or tibi-tarsal articulation of a deep rust colour. In this animal the eyes are peculiarly bright, soft, and beautiful. The fawn is of a lively fulvous brown, marked during the first year with numerous white spots. They rut in November and December, when the neck of the buck swells, and gestation lasts near nine months, the females dropping two or even three fawns. The bucks

lose their attire about the same period as the stags of Europe; they bray, but with less noise, and live in herds from the southern confines of the great lakes and the St. Lawrence to the Floridas and westward, in the interior to an immense distance. According to Professor Harlan, this species displays great enmity towards the rattle-snake, which it contrives to crush by leaping, with the fore-feet conjoined, and dropping perpendicularly on the serpent, bounding away again with great lightness, and repeating this attack till the enemy is killed. This species of deer is subject to considerable variations, probably arising from difference of colour, but the specific distinctions are very uniform. Its flesh is very palatable and wholesome, and its skin, which is soft and flexible, is used for many purposes in domestic economy, and is said to resemble that of the chamois more than the skins of any of the common deer of Europe. It is altogether an interesting animal, and forms a very decided feature in the natural history of the districts in which it is found. It is rather more of a lowland animal than the red deer of the Rocky Mountains, but it possesses more elegance of form and more activity of habit than our fallow deer, at the same time its manners are gentle, and there is no doubt that it could be easily domesticated in its native country, and probably in Europe.

THE MEXICAN DEER—*Cervus Mexicanus*. This is rather a doubtful species, or at all events the part of America of which it is a native is not very clearly made out, though it is probable that it inhabits the table land, more or less, the whole way from Mexico to the southern extremity of the American continent; and that though it is a mountaineer in the tropical parts, it descends to the plains in Patagonia. The animal itself is little if at all known, but the horns have been in various museums for a considerable time; and as they are peculiar, it may not be amiss to give in substance the description of them, partly from Shaw and partly from the celebrated Grew, by whom the animal is styled the Indian Roebuck. It is probable that the same pair of horns still to be seen in the British Museum are those mentioned by Grew. They are of a bright yellow colour, so irregularly and widely palmated as to cause a suspicion that they once belonged to an unknown species of reindeer, or to a second species of elk. They are nearly seventeen inches long, spreading diagonally from the head and reclining back; there is no burr at the base, only a broad, ascending, tuberculated, and toothed beam. At two inches from the base an antler issues from the anterior part in a vertical direction, flat and ending in two points; about three inches higher the beam, being somewhat prismatic in form, widens, and a broad flat branch throws up four snags in the form of a palm, the foremost plain, the next toothed, the third plain, and the fourth bifurcated; behind these a fifth assumes a still more singular form, it ascends in the same direction with the others, terminating in three processes, and from its external posterior side throws out an horizontal branch which bifurcates again, the inferior being the longest and hanging downwards; this is the right horn; the left, after the basal antler, throws obliquely forwards a flat broad branch dividing into two processes, then vertically one with three external processes, and then a third likewise with three external processes, but these three branches flatten also at the base into a kind of palm obliquely facing the other.

Cuvier describes the horns as strongly curved for-

wards, spreading outwards, and converging towards each other at the extremities; an antler at the anterior face of the beam, pointing vertically, and furnished with strong denticulations; a spiller or antler at the posterior part of the beam, divided into several small branches; these horns flatten into a sort of palm from the second antler, and at their base are deeply grooved and strongly tuberculated. The head which Cuvier describes is that of a very old specimen, which was furnished with a muzzle, but had no canine teeth; and in these and other particulars it appears that the animal bears so strong a resemblance to the Virginian deer, that it is probably only a variety, and that this deer extends throughout all the temperate parts of America, being subject to some variations arising from differences of climate and pasture. The following are descriptions of some of the museum specimens of the horns. In the collection of the late Mr. Brooks there was a pair of a bright golden yellow colour, very robust, rising from the burr with strong pearls, and a small antler in front; behind this, and in contact with it, a second snag, strong, vertical, notched, and grooved; the beam then bends out at an angle, horizontally and laterally, and then curves forward. On the superior edge are three bifurcated snags, two vertical, and the third bent forwards; but what seems to confer a decisive character on these horns is, that beneath these, on the inferior edge of the beam, a sixth heavy snag hangs down perpendicularly, widened and flattened at the base, and evidently much worn by friction, while the animal grazes; this is the character on the left; the right is similar, excepting the extreme points, which appear to have been injured in the development. In the British Museum, there is another similar pair with the worn clavate suspensal snags, but less in proportion. These two specimens seemed to justify the appellation of *Cervus clavatus* for a new species, but they are the companion of several others in the British Museum. There are, however, so many uncertain points in the history of this species, that it must be received with much caution.

THE LARGE-EARED DEER—*Cervus macrotis*. This is also an American species, resembling the Virginian and Mexican deer, and also in some respects the wapiti; but according to the descriptions of Harlan and Say, it is different. The upper part is light reddish brown, and the sides and fore part of the nose ash colour; the back intermixed with blackish tipped hairs, which form a distinct line on the neck near the head; tail reddish-cinereous black at the tip; this part is somewhat compressed, and almost naked beneath; the hoofs are shorter and wider than those of the Virginian deer, and more like those of the wapiti; the horns slightly grooved and tuberculated at base with a similar antler, as in the Virginian; the beam less curved forwards, is bifurcated near the summit, again divided, the anterior of the second bifurcation being somewhat longer than the posterior; the ears very long, extend to the principal bifurcation, about half the length of the whole horn; the lateral incisor teeth are larger in proportion to the intermediate than in the Virginian; eyelashes black; lachrymal apertures also larger, and the hair coarser, and undulated, and compressed like that of the wapiti. The species is found in the most remote north-western territories of the United States, and from the context of this description it appears evident that the Guazupuco deer is nearest allied to it, and that the guazuti and the Virginian are clearly of the same group.

THE LONG-TAILED DEER—*Cervus macrourus*. This species is described as being larger than the red deer or stag of Europe, darker in colour on the upper part, and having the belly white, the tail, from which it gets its specific name, different from that of most species of deer, is about eighteen inches in length, black on the upper part, but with broad white margins, and carried erect when the animal runs. The



Cervus macrourus.

horns are short, and altogether of small size and flattened, but not palmated. This species of deer is described as being very numerous in the dry plains near the banks of the river Kansas in North America. This river is one of the western branches of the Missouri, and drains by its different forks a region of 500 miles in length by more than 100 in breadth.

THE GUAZUPUCO DEER—*Cervus paludosus*. This species inhabits the low and swampy regions of South America, and is described by D'Azzara as having horns rather large and cylindrical, terminated by a fork, with an anterior antler some way up the beam, simple or bifurcated, pointing forwards and then vertical; his muzzle is large, figured like that of an ox; the eyes large and full, with a lachrymal fold beneath; the forehead below the horns flat; the ears terminating in a point; the pedicles of the horns are one inch high, and the horns about one foot four inches in length, with never more than five snags; mammae four, disposed in a quadrangle; the eyelashes black, surrounded with white, which passes along the side of the face, and surrounds the muzzle and the mouth; a black velvety spot in the angle of the lower lip, another shading the nose on the upper; a black triangular one on the nose, and another between the eyes, united by a dark line between them. Inside of the ears, under jaw, and cheek, white; a black spot on the interval of the hoofs of all the feet, ascending to the second joint; a black band passing along the breast, and another on the upper part of the tail. The size of this animal is nearly the same as that of

the European stag, being four feet high at the shoulders, and four inches higher at the crupper. The prevailing colour on the upper part is reddish bay; the tail is of medium length, and the two incisive teeth are larger than the rest. The females are smaller than the bucks, and without the black line on the breast. The fawns are of a uniform dun colour, and without any spots. The hair on the posterior part of the abdomen, and all the way between the hip and the under side of the tail is very long, white for the greater part of its length, but with dark points.

This species is most abundant in the swampy regions of Paraguay, in the centre of South America, and according to the account given by D'Azzara, the season of rutting and also that of shedding the horns are not so determinate as in the deer of the northern hemisphere. This is not to be wondered at, if we consider the character of the country which these animals inhabit. When the rains set in, a very great extent of the surface is laid under water, by which means the deer are dispersed to the margins of the temporary lakes, where they find abundant food; and as the dry season comes on, and the waters subside, they retreat upon the remaining portion of the marsh, which is seldom dried up even in the hottest season. These animals may, therefore, be regarded as enjoying a perpetual summer; and, therefore, as is the case with most animals which enjoy this, their breeding is not confined to one particular season, but is distributed over the whole year. We still know too little of the natural history of South America for being able to decide with precision the geographical situation of this or any other species; but it is probable that the one under consideration is very generally distributed over all the swampy grounds.

THE GUAZETI DEER—*Cervus campestris*. This is also a South American species, but inhabits the dry plains rather than the bushy margins of the marshes. This is smaller than the former species, being only about two feet six inches at the shoulder, and two feet eight and a half at the croup; the horns are a foot long, slender, with the beam suberect, a branch anteriorly placed, bent upwards, and posteriorly one or two snags towards the summit; the eyes are large and brown, with a suborbital fold; the ears erect and pointed; the fur smooth and close, is reddish-bay, the hair being reddish-bay at the point, and dull brown at the base; the inferior parts of the body, the under side of the head and tail, which measures six inches, are white, as also the hinder part of the buttocks, and internal face of the thighs, a circle round the eyes and inside of the ears. The hair on the lower part of the abdomen is not so much produced as in the species last described.

It is understood that this species is also very generally distributed over South America, and that it is particularly abundant in Patagonia, the plains and valleys of which are much more perennially green than those of the more tropical parts of America. It resides in the open plains, is remarkably swift; and the male emits, when pursued, a strong smell of onions; which, however, is supposed to result more from feeding on bulbous roots than from any natural quality in the animal, as some specimens which have been kept alive in Europe and fed upon grass, have not emitted the same odour. The horns of this, and indeed of most of the South American species of deer, are, however, subject to so much variation, that there is some difficulty in making them out. The horns of

deer are, indeed, perplexing matters. As we have already said, there are, at least, ten times as many pair of horns as deer; and these pairs are not only all different by nature in different years, but they are liable to accidental differences from hurts or otherwise; and we have further reason to believe that not only difference of climate varies them, but that they are farther varied by differences of seasons. They are seasonal productions, as well as annual plants; and the feathers of birds are, and we know that these are, affected by the character of the season. Farther we know that, in the same species, and even in the same group of deer, the horns are less produced in warm climates than in cold ones; and it follows, by parity of reasoning, that they should be less produced in warm seasons than in cold ones. These and many other circumstances render it very questionable whether the form of the horns ought to be taken as the characteristic of the different species of deer; and it is certainly true that much perplexity has been occasioned by the horns of the less known species, and particularly by shed horns, the owners of which are altogether unknown.

THE CARIACOU DEER—*Cervus nemoralis*. This species is considered as a variety of the Virginian deer; though it is understood to inhabit more southerly latitudes, being abundant in the woods of tropical America. In the United States this animal is called the roebuck; and it bears considerable resemblance to the roebuck of the eastern continent. The following is Hamilton Smith's description from specimens of Virginian origin, which were kept in the hospital gardens at New York: "The horns not more than eight inches long, somewhat vertical, rugous at base, with a small antler not above an inch in height, rising vertically at a short distance up the anterior part of the beam, which at the insertion of the antler, bent back, and then being slightly flattened, turned inwards and forwards in a slightly uncinated bend, throwing off a posterior short snag, which constituted a bifurcation; the buck and does were nearly of the same size and colours; the head rather round, not so prolonged as in Guazeti, and the body longer than the roebuck, about twenty-eight inches high at the shoulders and thirty at the croup; the neck, shoulders, sides, and back, were of a yellowish brown grey; the inferior part of the belly, edge of the buttocks and under tail white; the face darker brown grey; leaving the region round the nose, lips, and chin likewise white, with a black spot on the nose, one at each side of the mouth, on the upper lip, and one at the corner of the lower lip; the space round the orbits and cheeks, dun, with a little whitish favour behind the eye; the ears moderately long and pointed, were brown-grey outside and whitish-grey inside; the eyes full, dark, and soft, with a small suborbital fold beneath; the muzzle small, round, and black: from the knees downward to the fetlock was a dark streak, but the rest of the limbs ochry; and the tail about four inches long, was dusky above, without any long white hair at the edges.

"While engaged in making the sketch, they were fed with bread, and the buck, jealous of the does sharing the dainty, showed his propensity to leap, for he drove them off by butting them, the head turned sideways, not unlike a goat in play, rising for the purpose high upon his hind legs, and not by running with the head low like the stag. It being in the month of March, their mewing period, he broke one

horn off in this sport, and then made several surprising vertical bounds, but only one drop of blood escaped from his head, and he stole away in a crouching gait under a shed.

"This species is common in all the warmer parts of the American continent which abound in forests. The mahogany-cutters of Belise often meet with it in the woods. It is very lively, but at the same time a most gentle creature, easily tamed, and very familiar in confinement. We are still, however, in want of information respecting it, and also several others of the forest deer of America, the haunts of which are very difficult to explore."

Besides the species which have been enumerated, there is an entire group of deer on the American continent which differ altogether in the form of their horns from the deer of the eastern world, as well as from those species which we have described. They are generally styled *brockets*, from the circumstance of their horns never acquiring any branches, but remaining as single dags, similar to the prickets or first horns of the European stag. The deer of this group are mostly of small size and light make; they are very numerous in some parts of the country; and as the females very much exceed the males in numbers, it has sometimes been alleged there are species of deer in America the males of which have no horns. This is certainly not true, but the horns of this group are insignificant as compared with those of most of the genus. The animals themselves are generally below the middle stature of deer; their nose is pointed, and their muzzle small, consisting of a glandular termination at each side of the nostrils. Their lachrymal sinuses are small, and their colours are generally uniform, the prevailing one being bright reddish brown. They inhabit the thick swampy forests, and are found only in the warmer parts of the continent. Several species are mentioned, but we are in want of precise information respecting them.

THE PITA BROCKET—*Cervus rufus*. This is a very lightly formed and handsome animal. The male or buck is styled *Guaru Pita* in Brazil, and it is rather taller than the roebuck of Europe, but more lightly made. The head is very pointed, and the muzzle small, but giving an enlarged appearance at the sides of the nostrils. There is a lachrymal sinus before the eye, and the male has canines; the horns are always simple with a small burr at base, and the pricket about five inches long; the body is of a lively reddish bay, excepting the face and feet, which are red brown; the lips, chin, surface between the under jaws, under part of the tail, and lower abdomen, are white; the throat and internal face of the thighs whitish grey; the tail with the hair is nearly nine inches long, and red bay above; a circle round the eyes is occasionally paler than the rest of the head: the females have the same colours, but are smaller in stature. These animals are found chiefly or entirely on the eastern side of central America, from Honduras to the southern extremity of Brazil, along which line the low country is generally very much wooded, and therefore adapted to their habits. They are gregarious, living in large herds, and are almost the only ruminating animals which are so, and at the same time of a strictly forest character. The males are polygamous; and, as already mentioned, their numbers are few compared with those of the females. They are much preyed upon by the jaguars, and also by the larger species of boa.

The APARA BROCKET—*Cervus simplicicornis*. This is a smaller species than the former, standing only about two feet and a half at the shoulder, and being, as is understood, destitute of canine teeth. The profile is remarkably straight, and the horns, which are small and shorter than the ears, are continued in the same line with it. This is a red deer as well as the other, but its colour is brighter, its tail shorter, and furnished on the under side with longer hair. There is a dark ring round each eye, and the mouth is dusky. The specimens of this species which have been examined and described in Europe, have been chiefly brought from Brazil, where they are understood to inhabit more on the open plains than the species last described. They appear to vary very considerably in their colours with age, so that there is some uncertainty about their natural history.

The BIRA BROCKET—*Cervus nemorivagus*. This as its name imports, is a wanderer in the woods. It has sometimes been confounded with the apara, but it is a much smaller and more gentle-looking animal. It is only about a foot and a half high at the shoulder. The horns are straight, smooth, solid, and pointed; rather more than half an inch in diameter, and not exceeding two inches in length. The tip of the ear is rounded, and the lachrymal sinus is very small. General colour on the upper part greyish brown, the hair being brown, with yellowish white points. The lips, the chin, and the middle of the breast are white; the belly, the whole of the fore-legs, with the exception of the outside of the knees, and a space round the eye are buff coloured, the outsides of the hind legs are fawn; the animals are remarkable for the gentleness of their appearance.

The species of which we have given an enumeration comprise at least the greater number of living deer which now inhabit the earth, though it is by no means improbable that in America, both North and South, in the central mountains of Asia, and in the Oriental isles there may be species with which we are not acquainted, and it is possible that some of those which are now described as species may be only accidental varieties; for most species, and particularly those of the warmer climates, are subject to albinism, and also to occasional differences in the forms of the horns.

There is no genus of animals more interesting to the naturalist, in every point of view, than the deer. With the exception of Africa and New Holland, they are found upon every large portion of land on the surface of our globe; and they appear to have existed coeval with some of the races of animals which are now extinct. They have even a fossil history, to which it is of some consequence to attend; and for this purpose we shall briefly mention the principal ones whose remains have been found in the earth.

FOSSIL DEER. The most remarkable of these is probably that which has been so frequently met with in the bogs of Ireland, and which has been styled the **IRISH ELK** from the form of its horns, though in the rest of its anatomy it approaches more to the character of a stag. The horns of this fossil species so far resemble those of the elk, that they have large palms which are placed edgeways to the front, and extend wide in a horizontal direction. But they differ in the number and extent of the snags upon the posterior margins of the palms, not being more than eight or ten, while in the mature elk the number is sometimes as many as forty. They differ also in having a brow

antler projecting from the beam of the horn immediately over the burr, which antler is enlarged towards its extremity in all the specimens, and in some of them it is forked. It is understood that these deer in so far resemble the reindeer as that both sexes were furnished *with* horns, and horns of immense dimensions; the entire length of some of them, including the portion of the cranium between, being not less than ten feet. But though the horns are of this immense size, it does not appear that the animals themselves have been proportionally large; for the bones of the head are not larger than those of a full-grown stag. This species appears to have been very numerous in Ireland, three heads having been found in a single acre; and Molyneux mentions that in less than twenty years thirty had been picked up. These animals have been contemporary with the fossil elephant, which is now extinct as a living inhabitant of Europe; and though they are more abundant in Ireland than anywhere else, they are by no means confined to that island; they have been, however, found in the Isle of Man, and several parts of Great Britain, in France, on the banks of the Nile, and in the valley of the Po; and there is no doubt that proper research would find them in many other parts of Europe; so that we have every reason to conclude that at some very remote period of history, when the state of the country was very different from what it is now, they were very generally and abundantly distributed.

Another fossil species is the fallow-deer of Scania, in Sweden, mentioned in the memoirs of the academy of Stockholm, for 1802. These bones, which were found in a fresh water deposit, are much larger than those of the existing fallow-deer; and yet they differ so much from the horns of the reindeer that they cannot be referred to an accidental variety of that species. They have a single brow antler upon each horn, placed on the beam, between four and five inches above the burr, but small and perfectly simple, and thus totally different from the antlers of reindeer, while the palms of them are vastly larger than those of the horns of fallow-deer.

In the south-west of France there are found the remains of a deer bearing very considerable resemblance to those of the reindeer of the present day, but the animal itself has been considerably smaller, not exceeding the common roebuck. These remains are found in the sands of Etampes, and also in caves, at Breugens in the department of the Lot, at which latter place they are mingled with the bones of the horse, the rhinoceros, and various other animals. The horns stand more erect than those of the reindeer; and though there are several points of resemblance, there is question that the owners of these remains have belonged, if not to a different species, at least to different variety, from the common reindeer. The existence of those remains in the same charnel-house with the bones of the rhinoceros, is a singular and somewhat puzzling point in the natural history of our globe. The reindeer is now found only within the arctic circle; and the rhinoceros only in tropical countries. The fact of their remains being found together, leaves no doubt that they have been co-inhabitants of the temperate parts of Europe. Thus the geologists are put upon the horns of a dilemma; because neither the assumption that Europe was once colder than it is now, nor that it was once warmer, will meet this case, in as much as, so far as our present knowledge extends, we have the remains

of the polar animal and the tropical in the same grave.

In the fresh water formation of calcareous matter at Montabuzard, there are found the remains of a species of roebuck, together with two species of lophesdon, and one of mastodon, both of which are now extinct in all parts of the world; so that we know nothing of the kind of country which was adapted to their habits. This fossil species resembles, in many respects, the deer of the Oriental islands, and more especially the deer of Timor, which is the most remote from Europe in its habitat of any with which we are acquainted.

On the deposits near the northern shore of the Mediterranean, there are also various species of deer, some of which resemble the deer of the eastern islands; and, what is singular, their remains are mingled with those of tigers and panthers, which are now natives of warm countries only, as well as with those of the Alpine hare, which are now found living in only the coldest regions of the world. These particulars are highly curious; but they set all our theories at defiance, and render it impossible to say probably what may have been the condition of Europe at some former period of its history.

DEERINGIA (R. Brown). A genus of East Indian biennial herbs, belonging to the natural order *Amaranthaceæ*, and nearly related to the *Celosia* or cockscomb.

DEILEPHILA (Ochsenheimer). A genus of lepidopterous insects, belonging to the section *Crepuscularia*, and family *Sphingidæ*, or hawk moths, having the wings entire and acute, the spiral tongue rather elongated, and the antennæ short, and gradually but distinctly clubbed in the males. These insects have much the appearance of the insects to which the genus *Sphinx* is restricted by recent authors, but the species are generally smaller, and more robust in appearance, owing to the comparative shortness of the abdomen. Mr. Stephens divides the genus "into two sections, corresponding with their diversities of habit and structure; the larvæ of the second section have the power of elongating or contracting the anterior portions of their body, thence called elephant sphinxes—a term which has been applied to all the species, but improperly." In addition to the external characters of the perfect insects, by which these two sections are distinguished, it may be added, that in the first of them, the caterpillar is completely covered with minute pale spots upon a dark ground, its anterior segments are not capable of being protruded to a considerable distance, and the horn upon the extremity of its back is rough, and the chrysalis is superficially buried; whereas, in the second section, the caterpillars are not minutely spotted, a large eye-like spot appearing on some of the front segments, which possess a very considerable power of protrusion; the horn upon the back is smooth, and the chrysalis enclosed in a cocoon of leaves on the ground. There are eight species of this fine and handsome genus indicated by authors as natives of this country, but two at least of them appear to have been species introduced with imported plants. Of these the *D. celerio*, which feeds upon the vine, has been the subject of much controversy amongst entomologists, amongst whom Mr. Stephens (Brit. Ent. vol. i. p. 128.) who contends against, and a writer in a late number of the Magazine of Natural History, who argues in support of their introduction as real inhabitants of this country, may be especially

noticed. The following observations upon the *Deilephila Euphorbiæ*, one of the rarest and most beautiful species of the whole section, will, we are sure, be read with interest. This species is found upon the sand hills of Braunton Burrows, near Barnstaple, in Devonshire, in the month of June. On its first appearance the wings are small, clumsy, shapeless appendages, and are more soft and yielding than the lightest silk which undulates with a breath, often remaining for some time stationary in a vertical position upon the stem of the spurge, allowing its wings opportunity to expand and strengthen as they droop behind it. In half an hour the wings are brought forward, and assume their usual position. About half an hour after sunset the *Deilephila* appears on the wing, circling over the various branches of spurge scattered over the surrounding waste, until a mate is found. The eggs are coated with a gummy substance, by which means they are easily attached to the small leaves of the spurge. They hatch in a fortnight, producing small black caterpillars, which shortly afterwards acquire a red head and tail*. Subsequently they grow very fast, gaining at each moulting additional beauty, by having red dorsal lines, and a great number of minute yellow spots, two lateral ones on each segment, being much larger. When full grown, Mr. Curtis informs us that "they are so conspicuous, that their numbers are reduced by marine birds which feed upon them; they are full grown about the middle of September, when they descend into the sand, and become chrysalides, forming a loose case of earth around them, from which the moths emerge the beginning of the following June. Sometimes, however, they remain in the pupa state two seasons, as many lepidoptera do—a wise provision of nature to prevent any accident from destroying the whole brood. The sand hills where the larvæ are found being of great extent, must have been collected by the winds and storms, to which they are constantly exposed. During the winter the whole soil is frequently removed so as completely to alter the surface of the country. A great number of the pupæ must consequently be destroyed, or buried at a considerable depth below the surface, where probably they lie hid until they are brought to light and life by the influence of the elements."—Brit. Ent., second edition. These circumstances mentioned by Mr. Curtis will enable us, in some degree, to account for the irregularity in the appearance of these insects mentioned to the author of this article by Mr. Raddon, the gentleman by whose exertions the majority of specimens have been obtained, and since published by him in the Entomological Magazine. Since 1819, he has, however, been unable to obtain but a single chrysalis, and the person by whom this was found informed that "the valley in which you desired me to search is completely filled up by the sand, and the whole surface completely altered by the wind." The late Captain Blomer was not able to capture one, although he resided some years upon the spot; and Mr. Cocks, in a letter to Mr. Raddon, says, "it is now ten years since I took the larva, and although I have regularly been in the habit of visiting the locality every year several times, I have never been able to take it since;" although, in 1814, they were so plentiful, that Mr. Raddon found not less than a hundred minute larvæ

upon an armful of spurge, which he had cut at dusk the preceding evening. The rarity of the insect is also greatly increased by the difficulty of rearing it. The late Mr. Fuseli, the Royal Academician, who was a zealous entomologist, was enabled only to obtain one moth from upwards of twenty chrysalides.

The only species abundant in the neighbourhood of London is the *D. Elpenoz*, the caterpillar of which feeds upon the ladies' bed-straw in Hackney marshes, Battersea Fields, &c.

DELPHAX (Fabricius), a genus of homopterous insects belonging to the family *Fulgoridæ*, having the antennæ inserted in a notch on the lower margin of the eyes, and being about as long as the head, with the first joint shorter than the second. The ocelli are distinct; the head is produced in front into a short pointed and flattened snout, and on its underside it is elongated into a tubular proboscis, directed towards the breast, and which is the instrument by which the insects are enabled to inflict wounds on the leaves and twigs of plants, and to suck up the fluid which flows therefrom.

There are numerous British species belonging to this genus, of small size, found amongst grass and rushes, some of them occasionally do not have their wings developed fully: whereas the same species in certain seasons, and under peculiar circumstances, of which we are unable to ascertain the nature, acquires full-sized wings and wing covers, which latter are, however, not more coriaceous than the former. Mr. Curtis, not aware of this remarkable peculiarity, has formed the subapterous individuals into a distinct genus, under the name of *Criomorphus*.

One species of this genus, the *Delphax saccharivora*, or the *Cane-fly* of the West Indies, is exceedingly injurious in its ravages upon the young and growing sugar-canes in Grenada, and some other of our West Indian possessions. A correspondent of the Magazine of Natural History (vol. vi. p. 407), thus describes the nature of its attacks:—"For these last six months, (back from March 1833), the island of Grenada has been infested with a species of insect that threatens not only great injury to the present crop of sugar-cane, but also to render the labours of the planter entirely abortive for the next crop. I am not aware that any species of insect hitherto noticed has been found so formidable, either in number or destructive qualities, as the cane-fly, which is now propagating, and so rapidly over-running the sugar plantations in this colony. The insect, formed with a snout and beak ending in a bristle, attacks the cane in all stages of its growth, but is more particularly injurious to plants or ratoons when they are young and tender. The under surface of the leaf, and towards the mid-rib, or the course of the larger sap vessels, is selected by the insect for the scene of its operations. There it makes an oblique puncture, resembling that which would result from a lancet introduced in the same direction. Into each of these punctures from five to fifteen eggs are deposited, and each egg is placed transversely with respect to the direction of the fibre of the cane, which serves to overlap them, and thus afford a protection from the many enemies they have amongst the insect race. The aperture is then covered by a very slight substance, resembling that which protects the eggs and young of various species of spider. This substance is always to be observed attached to the posterior part of the body of the insect. When the insect appears on the surface of the leaf after its

* Abridged from the Entomological Magazine, No. 9.

first transformation, it seems dull and inactive, and is generally covered with a light floss of the substance already mentioned; but having changed its skin, which it leaves perfect and attached to the leaf, it becomes lively, active, and voracious, and joins in the works of propagation and destruction. There can be no doubt, or at most but little, that the *Aphides* (as the writer erroneously termed the insect to which they, indeed, bear much resemblance in their habits), do not select the sugar-cane merely as a medium for the deposition of their eggs, but that, like millions of other creatures, they also regale themselves with its sweets, and from their numbers, literally to bleed the plant to death.—Like most of its tribe, it produces the substance called honey dew, so much so, that the upper surface of the leaf infected is covered over with it. This substance when dry, becomes black and of a light texture, which being nearly insoluble in water, destroys and interrupts the action of the atmosphere, and aids in the general destruction of the plant.”

DELPHINIUM (Tournefort). An extensive genus of herbaceous plants, natives of many different parts of the world. Linnæan class and order *Polyandria Trigynia*, and natural order *Ranunculaceæ*. Generic character: calyx corolla-like, of five sepals, the upper one spurred; corolla of one or four petals, the upper one having a posterior horn, the lower sometimes cleft; stamens below the germen; filaments dilated at the base, and short; anthers terminal, oval, two-celled, cells bursting outwardly; styles three or five, and short; stigma emarginate; capsules one, three, or five, having membranous follicles, and with a placenta fixed to the suture; seeds angular and albuminous. From the peculiar form of one of the petals, these plants have received the English name of larkspur, and whether annuals or perennials have always a place in flower gardens. The first are every year raised from seed, the second are increased by dividing the root. The flowers are not only remarkable in form and variety of colours, but also for the intensity of their various tints; the double *D. grandiflorum* is perhaps the deepest blue of any flower we possess.

DELPHINULA (Lamarck; *TURBO-DELPHINUS*, Linnæus). This genus of shells, possessing the round aperture of the genus *Turbo*, probably induced Linnæus to consider it of that family; but the united margin of the mouth at once distinguishes it from the turbines. In many respects it approximates to the genus *Scalaria*, like which it has its whorls sometimes drawn out and detached; but its nacreous substance, in addition to the following distinctions, clearly proves it as not allied to the family. The shell is solid, conical, or sub-discoid, umbilicated, thick, pearly within and under the external coloured coating: the aperture is entire, round, or sometimes trigonal; the whorls of the spire rugged on the outside, and angular on the side of the umbilicus (which is filled with short spines proceeding from the interior side of the whorls not observed by Lamarck), no columella is visible, a calcareous operculum externally tuberculated, which also Lamarck presumed to exist, but probably had not seen; the exterior of the whorls is armed with spines, depressed and singularly palmated at the summits, tubercles, or scabrous striæ, which we have said, give it a ragged appearance. Its pearly substance proves it a marine shell, and distinguishes it from the terrestrial genus *Cyclostoma*, though its rounded opening would otherwise entitle it to be ranked with them, in

so far as that distinction holds good. Common as this shell is, it is remarkable that the animal is unknown, but every reason exists to rank this genus in the second class, *Paracephalophora*; second order, *Asiphonobranchiata*; second family, *Cricostoma*. It appears to occupy a natural position in following the genus *Turbo*, and preceding the genus *Turritella*. All the known species inhabit the Indian ocean, and about four are described. There are, however, more known in a fossil state. De France, indeed, enumerates thirty in the formation prior to the chalk stratum.

DEMETRIAS (Bonelli), a genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Brachinides*, having the body long and flattened, the tarsi have the penultimate joint bilobed, the chin is obscurely toothed in the centre, and all the palpi have the last joint rather dilated at the base, and pointed at the extremity. There are but few species of this genus which seems to be confined to Europe, two only are British; the type, *Carabus atricapillus* (Linnæus), is of small size, and chiefly found under the bark of trees. It is of a buff colour, with the head and breast black, and thorax reddish.

DENDROBIUM (Swartz). One of the most elegant of the epiphytes found in the East Indies and New South Wales. It belongs to the class and order *Gynandria Monandria*, and to the natural order *Orchidææ*. It may be increased by division of the root, and though its natural station be on the stems of trees when wild, it grows well in pots of moor turf. It thrives best in a moist stove, and flowers frequently.

DENTALIUM (Linnæus, and modern authors). This very singular genus of molluscs is so generally well known that an elaborate description of them would be superfluous. The shell is a conical testaceous tube, nearly regular, slightly curved, gradually attenuated towards the posterior end, and open at both extremities, resembling an elephant's tusk in miniature, whence its name. Some species are longitudinally ribbed, others with slightly marked annular ribs, formed by the different stages of growth; but the greater portion of these shells are smooth on the exterior. The animal's body is lengthened, subvermiform, enveloped in a fistulous mantle, terminated by a belt or thickened band, pierced in its centre by an orifice with fringed edges; the foot altogether anterior, probosciform, terminated by a conical appendage, received into a species of cup with festooned edges; the head is distinct, oval, a terminal mouth in the middle of a digitated lip, a pair of lateral jaws armed internally with very singularly formed dental processes. The *D. elephantinum* illustrates the species having ribs or striæ longitudinally placed; the *D. entalis* those which are nearly smooth, or merely presenting the striæ of progressional growth; and to these may be added such species as are narrowed towards their orifice, and the interior doubled by another tube, forming De France's genus *Entalium*. The precise position these molluscs should occupy in the system of malacology cannot at present be finally determined upon, as a further examination of the animal is indispensable. The comprehensive mind of the great Swede suggested their being allied to the *Carinaria* and *Patella*, and modern authors have therefore placed them provisionally in the third sub-class *Paracephalophora hermaphrodita*, first order *Cirrhobranchiata*.

DENTARIA (Linnæus). A genus of tuberous

rooted herbs, chiefly natives of Europe. Linnæan class *Tetradynamia*, and natural order *Cruciferae*. These plants are nearly allied to *Cardamine*, but differ in having tooth-like scales at the root. They grow readily in light soil, and are increased by dividing the roots.

DEODARA. The specific name of a cedar found in India by Dr. Roxburgh, and introduced into this country in 1822.

DERMESTIDÆ, a family of coleopterous insects belonging to the section *Pentamera*, and sub-section *Necrophaga*. This family is of small extent, but comprises several very obnoxious species of beetles. The body is generally oval, rounded at each end and somewhat convex, the antennæ short and clavate, sometimes varying in the sexes; the legs short, with the tarsi five-jointed, and not contractile as in the *Byrrhidae*, the tibia being long and narrow. The genera are *Dermestes*, *Ctesias*, *Megatoma*, *Attagenus*, *Limnichus*, *Trogoderma*, *Globicornis*, and *Anthrenus*. The last named genus, as well as *Aspidiphorus* and *Throscus*, seem to unite this family with the *Byrrhidae* or pill-beetles, with which they are associated by some authors. Of these genera the only one which offers any interesting observations in respect to their economy, is the first, which is the type of the family, and which has received its name from the circumstance that the species of which it is comprised especially attack dried skins, the Greek word *derma* signifying a skin. The mischief which they thus often occasion to very costly materials, has occasioned them to be well-known. The perfect insect, on the contrary, seems only to live for the purpose of continuing its kind, being often found upon flowers, and if it frequents animal matter, it is only in order there to deposit its eggs instead of producing fresh ravages.

It is chiefly in collections of natural history, and in the warehouse of the furrier, that these injuries are committed; in the former they entirely destroy prepared beasts, birds, and insects, and in the latter all kinds of skins, of which they gnaw the surface so as to cause the hair entirely to fall off. They also attack the carcasses of animals exposed in the fields, devouring all the fleshy and tendinous parts, so as to make perfect skeletons of their prey. They also feed upon bacon (whence the name of the typical species *Dermestes lardarius*), feathers, horns, &c. Indeed, it is difficult to guard against their attacks: they elude our search by their small size, and our precautions by their perseverance. Nevertheless, in the great economy of nature, it cannot be denied that these animals tend towards the general good by destroying those kind of putrifying matters, and converting them into a material serviceable for the support of plants, inasmuch as that the air and moisture do not come into action towards the same end so quickly. With the assistance, therefore, of the *Silphæ*, *Histeres*, *Necrophagi*, &c., these insects effect the reduction to their former elements of such portions of carcasses as the flesh-fly has spared, which attacks only the flesh when in a fresh and moist state, and leaves the skin entire.

The *Dermestidæ* seem to prefer dark situations, where they remain inactive, and move only when disturbed, with a trembling kind of gait; they are seldom seen on the surfaces of the substances upon which they feed, but conceal themselves. The larvæ are long, diminishing towards the tail, and terminating in a truncated cone, having, also, two scaly horns on the last segment of the body; they are covered with long

hairs, and have a scaly head armed with powerful toothed jaws. They change their skin several times, according to Gœdart amounting to ten: the exuviae retain their form so as easily to be mistaken for the larvæ themselves; the back of the head, and several of the front segments exhibiting only a longitudinal slit. The larvæ, when full-grown, seek a convenient retreat, preferring the remnants of the matters upon which they have been feeding. The pupa is white, with the eyes, and several transverse markings of a brownish colour. When touched, it moves the abdomen with considerable force; the perfect insect appears in about a month. The larva of *Dermestes pellio* has a tail nearly as long as the body, composed of long red hairs. The best remedy against the attacks of these insects is the employment of arsenic in the preparation of zoological specimens.

The genus *Dermestes* is distinguished by having the antennæ eleven-jointed, shorter than the thorax, alike in both sexes, with the last joint of the papillary palpi shorter than the maxillæ. There are four or five British species, including the bacon-beetle *D. lardarius* which is of a black colour, with the base of the elytra dirty ashen colour, having three small black spots. It is about a quarter of an inch long, and is very common in houses, &c. *D. murinus* is generally found in moles, hawks, and other carrion hung up in fields or against walls. *D. vulpinus* infests the hides imported by shiploads direct from the Brazils; and so great is the damage which it occasions, that we are informed that the sum of ten thousand pounds has been offered as a reward for its destruction.

DESMANTHUS (Willdenow). A genus of aquatic herbs and shrubs found in the East and West Indies. Linnæan class and order *Polygamia Monœcia*, and natural order *Leguminosæ*. Generic character: calyx five-toothed; corolla with five distinct or united spatulate petals; inferior flowers apetalous; stamens ten, rarely five; pod evenly lengthened, and full of seeds. This genus was formerly ranked among the *Mimosas*, but separated by Willdenow. The terrestrial species thrive in loam and moor earth, and are propagated by cuttings; the others are grown in water.

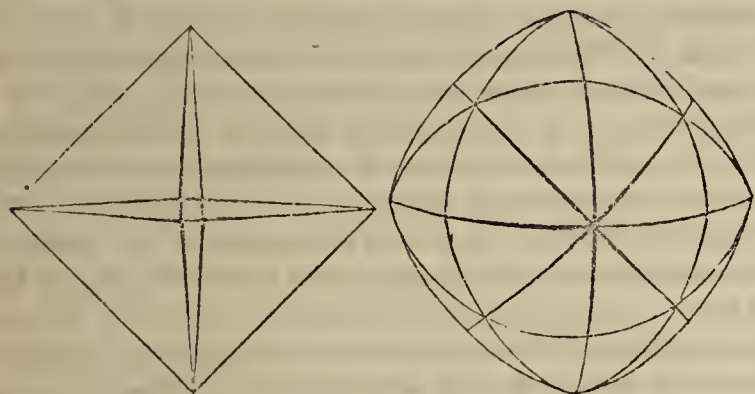
DESMODIUM (Decandolle). An extensive genus of herbaceous and shrubby plants, natives of America and Asia. They belong to *Diadelphia Decandria*, and to the natural order *Leguminosæ*. Generic character: calyx bracteate, somewhat two-lipped, the upper one cleft, the lower one in three parts; vexillum roundish; keel obtuse; wings short; lomentum jointed, with intervening compressions. These plants are raised from seeds or cuttings, and are kept in stove collections. Among them we find the moving plant of Bengal, formerly called *Hedysarum gyrans*, but now *Desmodium gyrans*. This plant is an annual or at most a biennial, having pinnate leaves, that is, one pair of small opposite leaflets, with an odd one of much larger size. These leaflets have a spontaneous motion when the plant is in a high temperature, say between seventy-five and eighty degrees of Fahrenheit, and at the same time in bright sunshine. The one slowly rises, while the other is depressed, thus alternating in position for hours together. These motions are only noticed when the plant is in the highest vigour, not being observable in very young or in very old plants. It is a phenomenon not yet satisfactorily accounted for by phytologists, but it has all the appearance in its action of that of a hydraulic machine.

DESMONCUS (Martial). A genus of South American palms belonging to *Monœcia Polyandria* of Linnæus, and to the natural order *Palmæ*. Generic character: spatha double; flowers sitting. Males—calyx trifid, corolla three-petaled, stamens six. Females—calyx and corolla urceolate; stigmas three, sitting; drupe one-seeded, shell having three pores in the shape of a star at top. This palm thrives in loam and moor earth.

DEWBERRY is the vulgar name of the *Rubus cæsius*, a small trailing plant found on barren ground, bearing fruit resembling those of the bramble, only much smaller.

DIADEMA (Ranzani). A genus of molluscs united to the genus *Coronula*, of which it forms a subdivision, and is there described.

DIAMOND, a mineral body of great value and hardness, first discovered in Asia. The primitive form of this precious stone is the regular octoëdron, each triangular facet of which is sometimes replaced by six secondary triangles, bounded by curved lines; so that the crystal becomes spheroidal, and then presents forty-eight small facets. These two peculiar characters of the diamond are exhibited in the subjoined figures.



The diamond has been found of a great variety of colours, but those that are decidedly colourless, and those that approach to a rose tint, are most esteemed.

Many stones when rubbed exhibit very distinct electrical effects, and they will attract or repel light bodies which are brought into their neighbourhood. The diamond, when excited, exhibits positive electricity; whereas the other precious stones, if rough, afford negative electricity. In general, however, it does not retain this electricity for any considerable length of time.

The diamond becomes phosphorescent when exposed to the rays of the sun. Many diamonds, however, do not possess this property, although agreeing in colour, form, and transparency, with those which readily become luminous. The continuance of the phosphorescence varies from five or six seconds to a full hour, and this even when the stone has not been exposed more than a few seconds to the rays of the sun. It is phosphorescent under water, as well as in the air. The diamond, when exposed to the blue rays of the prism, becomes phosphorescent; but when exposed to the red rays is not so. The spark from a charged jar produces the same effect as exposure to the sun's rays. Exposure to the light of a wax candle also produces phosphorescence.

Prior to the commencement of the eighteenth century, all the diamonds employed in Europe were imported from the provinces of Golconda and Visapour, in Bengal, and a few from the island of Borneo. They always occur in detached crystals in alluvial

soil; and this circumstance, no doubt, tended to give currency to the fiction of the "Valley of Diamonds" in the Arabian Tales.

Diamonds of any great value in a commercial point of view, were first brought from South America in 1720, and we may now briefly point out the modes of discovering them both in that country and Asia. In Brazil the natives collect the disintegrated sandstone met with at the bottoms of rivers and ravines, and, by washing, separate the clayey matter from the grains of quartz and diamond. The residue is carefully examined for the diamonds it may contain, which are distinguished by their adamantine lustre, and regular forms. In the district of Cuddapah, in Hindostan, the mode of working the diamond mine is as follows:—After all the superincumbent strata, and the large stones in the diamond bed, are removed out of the mine, the small gravel and other constituents of the bed are then carried to a short distance, and put into a cistern, about eight feet square, and three deep. In this situation water is poured upon it, which separates the lighter loamy particles. The gravel and small stones which sink to the bottom, are then thrown into a heap beside the cistern, from which they are conveyed to a smooth plane of about twenty feet square, made of hardened clay. Upon this the whole is thinly spread. The gravel in this position being slightly moistened, six or seven people go over it several times in succession. The first time they pick out only the large stones; the second and subsequent times, the smaller gravel is carefully turned over with the flat of the hand, whilst they as carefully watch for the spark from the diamond, which distinctly marks the situation of this valuable gem.

The locality of the diamond differs, however, in a geological point of view, very considerably in different parts of the world; and, as such, the modes practised by the natives for procuring these precious gems. Thus we find that the diamond mines, as they are called, situated at Banaganpilla, are scarcely any thing more than holes in the surface of the soil. None are deeper than twenty feet, and when a gallery is excavated under the rock, it is so low that the people are obliged to work in it sitting, a mode of operating which an Indian prefers to every other. The solid rock of the hills is an agate, consisting chiefly of a coarse grey hornstone, with rounded pebbles of the same species, or of jasper. At some depth, this rock becomes a ferruginous sandstone, the grains of which are finely cemented together. Through this solid rock they are obliged to make their way before they arrive at the bed in which the diamonds are usually found. They commence at different places as their fancy leads them, with a spot about twenty feet square, which, with iron instruments and steel wedges, they break into slabs and fragments, of from one hundred to five hundred pounds weight. In this way they descend to the diamond bed, which is fifteen or twenty feet under the surface; this bed extends round the whole hill, and is as regular in its thickness and extent as the unproductive beds in the same place: it consists of a conglomerate, composed of siliceous pebbles, quartz, calcedony, and jasper.

The diamond, on account of the splendour of its lustre, its peculiar play of colour, its hardness, and lastly, its rarity, is considered as the most precious substance in the mineral kingdom, and is particularly valued by jewellers. The diamonds purchased by jewellers are generally in grains or crystals, and some-

times coarsely polished. It is also used in the form of a powder by lapidaries, for cutting and engraving upon harder gems; by watchmakers in their jewelled timekeepers; and by glaziers for cutting glass. The diamonds chosen for cutting glass are all crystallised. The faces are curved, and hence the meeting of any two of them presents a curvilinear edge. If the diamond be so placed that the line of the intended cut is a tangent to this edge near its extremity, and if the two surfaces of the diamond laterally adjacent, be equally inclined to the surface of the glass, then the conditions necessary for effecting the cut are complied with. In addition to the cutting and engraving of glass, the diamond has been very advantageously employed in drawing minute lines on the surface of steel, by which all the beautifully variegated tints of the rainbow may be produced.

The largest known diamond is probably that mentioned by Tavernier, originally in the possession of the Great Mogul. Its size is about that of half an hen's egg: it is cut in the rose form, and, when rough, is said to have weighed nine hundred carats. Among the crown jewels of Russia is a magnificent diamond, weighing 195 carats. It is the size of a small pigeon's egg, and was formerly the eye of a Brahminical idol, whence it was purloined by a French soldier; it passed through several hands, and was ultimately purchased by the empress Catherine for a sum equal to about one hundred thousand pounds sterling.

There is only one other diamond which our space will permit us to notice. This is the celebrated "Pitt diamond." It was brought from India by an English gentleman of that name, who sold it to the regent duke of Orleans, by whom it was placed among the crown jewels of France. It weighs rather more than 136 carats, and was purchased for one hundred thousand pounds. This country is not celebrated for the size of the jewels which adorn the regalia of the sovereign; but there are some beautiful models in the British museum of those we have described. For an account of the chemical constituents of the diamond, see the *First Division* of this work.

DIANCHORA (Sowerby). A fossil species of shell, the animal of which is consequently unknown. The shell is thin, adherent, regular, symmetrical, equilateral, subauriculated, inequivalve, one valve hollow within, and convex externally; the other flat, articulated by two very distant condyles. It belongs to the order *Palliobranchiata*.

DIANELLA (Ker.) A genus of tuberous rooted herbs, indigenous to New Holland. Linnæan class and order, *Hexandria Monogynia*, and natural order *Asphodeleæ*. Generic character: corolla rotate, regular, six-parted, and deciduous; stamens below the germen, filaments bent, and thick at the top; anthers linear and erect; style filiform; stigma simple; berry globular, and many-seeded. These plants grow well in sandy loam, and are increased by dividing the roots.

DIANTHUS (Linnæus). A very numerous and beautiful tribe of herbs, much esteemed for the elegance of their flowers and for their fine scent. Linnæan class and order, *Decandria Digynia*, and natural order *Caryophylleæ*. The pink, clove, carnation, and sweet-William are all well-known favourites, and met with in every flower-garden; and some of the florist's varieties are highly valued and sold at high prices.

Carnations and pinks receive the greatest attention and care from the florist; the former is the *Dianthus Caryophyllus* of botanists, and the improved variety

of the clove of florists. It ranks as the chief of stage flowers, as it combines elegance of form with variety and delicacy of colours, and to these is added the most delightful fragrance. To have flowers in the greatest perfection, new plants must be raised every year; not but that old plants will continue to yield flowers for several years; but these being those of branches, are never so large or so fine as such as are produced on the central stem of a maiden plant. Young plants are obtained by layering the lower branches of the last year's layers; and though these be only the points of the secondary shoots, yet when separated from the parent stock, they become, as independent beings, ten times more vigorous and amplified than if they remained on their original roots.

The cultivation of choice carnations forms a principal part of the florist's business. They are usually named, and the superior sorts, especially if they are new, sell at high prices. New varieties are obtained from seed; but very fine stage or prize-flowers occur but as one in a thousand inferiors. A seedling of promising merit, may, by judicious culture, be advanced to rank with the best: and it is by accident, and such means, that our present stock of fine carnations has been in course of time obtained.

The standard choice sorts are perpetuated by annual layering. This is performed about the time or soon after the plants are in flower; but if layered before, or as soon as the shoots are ready, the better. If cultivated as stage flowers, they are kept in pots, and of a pretty large size, in order that their branches may be conveniently layered. If cultivated in beds, there they are also layered; because there must be an annual supply of young plants as well for beds as for pots.

Carnations are layered like other plants; the lower branches, which would not flower till the following year (supposing them to be left on the parent stool), are chosen; an incision is made with a keen pen-knife entered a little below the third or fourth joint from the top, and passed up the middle of the shoot as far as the next joint. This separated piece is called the tongue, and when the little piece below the bottom joint is cut square off, it is ready to be fixed in the soil. In layering, a little fresh compost is usually laid round the plant to receive the layers. In this, little furrows are made, and in which that part of the layer between the tongue and the root is bent down and firmly fixed by a little hooked stick. The layer is then covered with about three-quarters of an inch of the compost; and at the same time the point of the layer is gently raised upright, taking care that the tongue be kept apart from the place whence it was cut, and pressing the soil pretty closely over, and around the point of the layer to keep it in place.

New roots are soon produced at the lower end of the tongue, and towards the end of September are fit to be taken from the stools and planted in beds or pots previously prepared for them.

Some florists are very curious in forming their carnation compost; mixing together many different substances, as loam, sand, leaf-mould, and rotten dung of various kinds. Such a compost may be very suitable, but many successful cultivators use only the freshest maiden loam, made sufficiently rich and porous by a third part of thoroughly decomposed stable or old hot-bed dung. In this, carnations, whether in pots or in beds, thrive and flower in the highest perfection, provided they receive all other necessary treatment.

The management of carnations consists not only in placing the layers in suitable soil, but in taking care that if potted, the pots be well drained, so that water may not stagnate within, which would materially check the growth and spoil the beauty of the flowers. Water must be always supplied moderately, and without excess of either moisture or dryness. The layers when taken off the stools are first placed in small-sized pots, and usually shifted twice into larger, before they are brought to flower. The most perfect cleanliness, keeping free from weeds, and defending against snails, slugs, ear-wigs, and wood-lice, are all indispensable, through the whole course of their growth. When the stems are advancing to flower they are often attacked by the green-fly or aphides; these must be banished by tobacco-smoke, or some other means not hurtful to the plants. Props must also be timely fixed to tie the stems to, as they advance in height; and as several flower-pods will appear on the same stem, all but the topmost, or the two topmost, should be cut off; this is for the purpose of encouraging the principal flowers to bloom in greater beauty and amplitude.

In order to assist the flowers to expand regularly and handsomely, florists exercise certain manipulations which are exclusively their own; these are called hooping and carding. The calyx or flower-cup is liable to burst irregularly, that is, it will be rent lower down on one side than on the other; to prevent this, two expedients are practised: the first is causing the divisions of the flower-cup to open equally by assisting the backward ones with the point of a penknife; and the second is by hooping, that is, by fixing a band of matting or soft string round the middle of the flower-pod, by which means the divisions of the calyx are made to burst regularly. These precautions regulate the bursting of the calyx; and in order that the corolla, or coloured petals of the flower may be expanded laterally and symmetrically, circular cards (having a hole in the centre to embrace the calyx) are fitted on immediately behind the spreading petals of the corolla, the card acting as a support to the petals, which naturally incline to fall back. By these means the petals are exhibited in a plane; besides which every tint and form are seen to the best advantage, and when so dressed up by the skill of the professional florist, are certainly objects of great beauty.

These practices are only followed by flower-fanciers who exhibit their flowers at shows for prizes, and at which there is sometimes the most intense and lively competition.

Pinks receive nearly the same treatment as carnations, only instead of being layered, they are propagated by cuttings, technically called "pipings." This is usually performed in June or July, or as soon as the best sorts can be ascertained by view of their flowers. See article PINK.

The annual sorts of *Dianthus* are raised from seed; and all the other species and varieties may be propagated by layers or cuttings without difficulty.

DIAPERIDÆ. A family of coleopterous insects belonging to the section *Heteromera*, and sub-section *Taxicornes* of Latreille; the head is disengaged from the anterior margin of the thorax, which is either square or cylindric, and, as well as the elytra, not dilated into a flattened margin, as in the *Cossyphidæ*. Latreille places in this family the *Phaleriæ*, and some other genera which appear to belong to the family *Tenebrionidæ*, in which family, indeed, the whole of

the present group is arranged by Mr. Stephens, whilst Mr. Curtis considers the *Diaperidæ* as nearly allied to the *Helopidæ*; the perfoliated or serrated antennæ, which are never moniliform, will well distinguish them. The other genera are *Uloma*, *Diaperis*, *Hypophlæus*, *Trachyscelis*, *Coxelus*, and *Elcdona* (*Boletophagus*, Fabricius). The family is not extensive, as regards the number of species, some of which are elegantly marked and coloured, in which respect they certainly approach the *Helopidæ*. The species are of small size, and are, for the most part, found in fungi, Boleti, under the bark of decaying trees, &c. The typical genus *Diaperis*, Geoffroy, is distinguished by the antennæ, of which the three basal joints are slender, the remainder broad, transverse, and distant from each other. The type of the genus is the *Chrysomela boleti* of Linnæus, of a rounded form, and black colour, having the base and extremity of the elytra, as well as a central interrupted fascia, orange-coloured.

DIAPHORA (Stephens; *CYCNI*A, Hübner. Steph.) A genus of lepidopterous insects, belonging to the family *Arctiidæ*, and consisting of a single species, the *Bombyx mendica* of Linnæus, having the wings short, and clothed with but few scales, whence the English name of the moth (spotted muslin); the palpi have the terminal joint slender and obtuse. The name of the genus alludes to the great diversity between the sexes of this moth, the male being of an ashy brown colour, whereas the female is white, with black spots. It is about an inch and a half in expanse. We have already on several occasions noticed the occasional periodical delay which takes place in the development of insects, and this moth offers a still more curious instance, it being recorded by Marsham, that out of thirty-six caterpillars hatched from a brood of eggs, all of which fed together and spun their cocoons at the same period, twelve only appeared at the usual season; twelve more were produced the following year, and the remaining twelve the third season, as perfect and healthy as those produced at the first. The moth is not uncommon in marshy districts near London, appearing at the middle of May.

DIAPRIA (Jurine). A genus of minute hymenopterous insects belonging to the family *Proctotrupidæ*, and distinguished by the beautiful antennæ of the males, which have the joints globular and connected together by slender articulations and ornamented with whorls of hairs. They are found in grass, upon trees, &c., and are supposed to be parasitical upon other insects.

DIAZOMA (Savigny). A genus of molluscs united to the genus *Botryllus*.

DICERAS (Lamarck). A fossil genus of molluscs, approximating to the genus *Chama*, from which, however, it differs by being regular, equivalve, never attached by the lower valve, and the distinct character of the hinge.

DICERATA. The second family of the second order *Polybranchiata*. Second class *Paracephalophora*. The general characters of these molluscs is their possessing two tentacular retractile appendages placed on the upper part of the body in a kind of sheath, situated at their base; a membranous wing or sail, more or less extended above the mouth, the organs of respiration in the form of little branches, externally placed.

DICERMA (Decandolle). A genus of undershrubs, indigenous to India. Elegant diadelphous plants, formerly called *Zornia* and *Hedysarum*, by

Linnaeus, but since new named as above. They are easy of management and propagation, like other stove plants.

DICHELESTIUM (Hermann). A curious genus of parasitic, entomostracous, crustaceous animals, belonging to the order *Pæcilopoda*, and section *Siphonostoma*, having the body long and narrow, composed of seven segments, the first of which is larger than the rest, with a pair of slender filiform antennæ, a pair of short didactyle claws, a tubular sucker, three kinds of feelers, four short legs for prehension, terminated by several toothed hooks; the second and third segments are lunate in form and furnished with very short legs; the sixth segment is long and somewhat cylindric, and the last small and oval. The animal of which this genus is composed is rather more than half an inch long, and insinuates itself into the flesh and the gills of the sturgeon, as many as a dozen having been found upon one fish. Of this number three of the specimens were one-third smaller than the others, with the body curved: one of them lived three days when removed from the fish. They are enabled to retain firm hold of their prey by means of their strong frontal pincers.

DICHLAMYDEÆ, a subdivision of dicotyledonous plants, including those which have a double floral covering, or both a calyx and corolla. The greater part of the handsome flowering trees and shrubs are found in this division.

DICHONDRA (Forster). A genus of evergreen creepers, natives of the West Indies. Linnæan class and order, *Pentandria Digynia*, and natural order *Convolvulaceæ*. This succeeds well with ordinary stove management, and may be increased by cuttings.

DICKSONIA (Heretier). A genus of exotic ferns, so named in honour of James Dickson, a British cryptogamist of great abilities and unwearied industry. It belongs to the order *Filices*, and one of the species is a tree fern from St. Helena.

DICLIPTERA (Vahl). A genus of tropical plants, mostly under shrubs, belonging to the class *Diandria*, and to the natural order *Acanthaceæ*. Generic character: calyx bracteate in four or five divisions; corolla two-lipped, the lowest nearly entire; anthers two-celled; capsule roundish, nearly one-celled, dissepiment ultimately free, to which the seeds are attached. This genus is nearly allied to *Justicia*, but differs in the structure of the capsule. It thrives in rich light soil, and is propagated by cuttings.

DICLYTRA (Borckhausen). A diadelphous genus of plants found in the north of Asia and America, and belonging to the natural order *Fumariaceæ*. Some of the species were at first called *Fumaria*, and others *Corydalis*; but these, together with five others, are now known by the name first above given.

DICOTYLEDONES, or **EXOGENÆ**, a division of vascular, flowering, or phænogamic plants, in which the vessels are arranged in concentric layers, the youngest of which are external, and the cotyledons of the embryo are opposite or verticillate: the dicotyledonous plants have a more or less conical trunk, consisting of bark, wood, and pith; the wood being contained between the other two. The thickness of the trunk is increased by an addition of new matter between the wood and bark. They have reticulated leaves which are distinctly articulated with the stem. The veins of the leaves are much branched; the flowers have generally a double perianth (dichla-

mydeous), and frequently exhibit a quinary division. The embryo is furnished with two cotyledons (hence the term dicotyledonous), which after germination, frequently assume the appearance of leaves. By these characters the plants of this division are distinguished from those of the monocotyledonous class.

DICTAMNUS (Linnaeus). Hardy ornamental herbaceous plants, said to be natives of Crete, but long cultivated in this country under the name of *Fraxinella*. The flowers are decandrious, and accord in character with those of the natural order *Rutaceæ*. There are two species, both of which grow any where, and are raised from seeds. Dictamnus is also a specific name of an origanum (marjoram), commonly called Dittany of Crete.

DICTYOPTERA (Leach). The family of the cock-roaches (*Blattidæ*), on account of the flattened oval form of the body, the five-jointed tarsi, and several other less important characters, was considered by Dr. Leach as sufficiently distinguished from the other orthopterous insects to warrant its separation as a distinct order, to which he applied this name. His arrangement has not, however, been followed in this respect. See **BLATTA**.

DIDELPHUS—Opossum. A genus of marsupial, or pouched animals, inhabiting the American continent, and the first animals of this singular order which are known to naturalists. Their generic characters are ten incisive teeth in the upper jaw, and eight in the under, the intermediate ones in the upper jaw being longer than the rest; the three front grinders compressed, and the last four tuberculated; those above triangular, but the under ones oblong, and two canines in each jaw, making in all fifty teeth, which is a greater number than is possessed by quadrupeds of any other genus. Their gape is wide, and the appearance of the mouth ragged; but their bite is feeble, compared with the size of their biting apparatus. Their tongues are beset with horny tubercles, like those on the tongue of a cat; and their tail is in part naked on the under side, and prehensile. Their ears are large and naked, and their aspect is altogether very peculiar. Their hind feet have the thumb or fifth toe long, and capable of acting in opposition to the other four, so as to lay hold like a hand. The four toes which act together on the hind feet are furnished with nails; and when not used in grasping, the nailless one is turned to the rear, like the hind toe of a bird. Their legs are short in proportion to the size of their bodies; they plant their feet upon the round pad of the sole when they walk, and their rate of motion on the ground is but slow. In trees, however, which the greater number of them chiefly inhabit, they have much power of themselves, and climb and hold on with much address. Their eyes have the irides yellow, and the pupils are vertical, like those of the fox. It has been said of them that they have a gape like a pike, the ears of a bat, the feet of an ape, and the tail of a serpent; and, certainly, taking their characters all in all, they differ very much from the placental mammalia. The difference extends not only to the form of the body, and the structure of those parts upon which the classification is founded, but it extends to the very covering; the hair of the opossum being unlike that of most other animals. It is neither sleek nor frizzled; and it has more resemblance to whalebone than to common hair, and on the naked parts there are sometimes scales. This uncouth sort of covering the semi-

transparent ears, which appear reddish when seen against the light, the yellow sinister eyes, the short legs, and the singularly formed feet, give these animals a repulsive appearance, which is in no wise diminished by the very fetid and offensive odour which they give out. The different species vary considerably in their habits; but they may be generally described as nocturnal animals, the principal part of which inhabit trees, in the holes of which they lodge; and they prey upon birds, lizards, and other small animals. Some of them also haunt the margins of the waters and feed upon shelled mollusca and crustacea.

All the species have the general characters of marsupial animals, the most remarkable of which in the skeleton are the two marsupial bones attached to the pubis, which support the pouch. The whole of the opossums have not, however, a distinct and produced pouch, into which the young can be received, and, therefore, there are some distinctions between them in the economy of their gestation, which can be more fully explained when we come to mention the species. We shall have occasion to notice the general subject when we come to the article MARSUPIATA; and, therefore, we shall in the mean time confine ourselves chiefly to the popular description of the species.

They are, as we have said, all nocturnal animals; and they are all carnivorous; but they do not possess the same degree of power and energy as the carnivorous animals, properly so called; and they are remarkable for stupidity, or at all events they do not display the same cunning as the fox, though their eyes resemble those of that animal. The habit is different, however; for the opossums, generally speaking, seek their prey in trees, whereas the fox is an animal which, though fond of brakes and other cover, is incapable of climbing. The form of their hind feet enables them to lay hold of a branch, and retain that hold, while they have perfect command of the head and anterior extremities for other purposes. Thus they can make use of the crooked claws with which their fore-feet are armed, to help them in the capture of their prey. At settlements near the woods, where they are plentiful, these animals are sometimes apt to play the weasel in poultry yards; and, like that animal, they suck the blood of their victims.

It is not a little singular that marsupial animals should be found in two zones of the earth, which lie nearly on opposite meridians, the centre of the one about 120° east, and the other about 60° west of the meridian of London; and that in all the districts between them there should be no animal of this character, or even approaching to it. What stage of the geological duration of countries may answer to animals of this singular order, it is not easy to say; for, though we admit that a few specimens have been found fossil in our own latitudes, it is impossible for us thence to conclude that the animals belong either to an early or a late stage of the country; for we have them in the rich woods of South America, and in the comparatively barren extent of New Holland, while there are none in Southern Africa, which is intermediate between these, and partakes of the characters of both.

We shall now briefly enumerate the species; and first those in which the female is furnished with a distinct abdominal pouch for the reception of her young during a portion of the period of gestation, and as a place of safety occasionally till they are able to shift

for themselves. Of these there are three tolerably well established.

THE VIRGINIAN OPOSSUM—*Didelphus Virginiana*. This species is by far the best known, at least to the people of this country, from its abundance in the southern parts of the United States. But as it is very generally distributed over America as far as the borders of Patagonia, or at all events to the margins of the Pampas, the name Virginian is by no means descriptive of it: indeed there is nothing tends more to confuse the nomenclature of natural history, than the naming of natural productions, whether animal or vegetable, after places, or after individuals of the human race. The first method ties the production down to the place named; and though there may be no great harm in naming a particular breed of cattle, sheep, or pigs, after the place which is most famed for their production, yet in cases like the one under notice, it is very absurd,—the Virginian opossum being found over a range in latitude of certainly not less than five thousand miles, while the individuals are far more numerous in South America than in North, if the whole surface of each be taken.

The usual size of the opossum is the same as that of a cat; its covering consists of a mixture of black and white hairs, with the ears having the one part black and the other white. The head often entirely white. It is very generally distributed, inhabits the woods, is not timid in the vicinity of settled places, prowls about in the night, killing poultry, sucking eggs, and committing other little depredations; but we need hardly add that, to man, it is quite harmless. The young, which are often as many as seven in number, are exceedingly light and small, at the time of their birth; that is, the time of their first birth, when transferred from the internal uterus to the pouch. The gestation in the uterus lasts twenty-six days, at the end of which the young have no vestiges of eyes or of ears, and are, indeed, little else than small lumps of gelatinous matter. They do not open their eyes till about the fiftieth day; but they readily find out the teats in the pouch, and attaching themselves to these, they increase in size. They remain in the pouch, or at least resort to it occasionally as a place of safety, until they are grown to about the size of rats.

The Virginian opossum, extending as it does over so vast a range in latitude, is subject to much variation of colour. There is also considerable difference between the appearance of the young ones and those which have arrived at perfect maturity. The body of the young animal is generally of a yellowish-grey, mixed with some hairs entirely white, and others entirely black; the last of which are most abundant along the back, and give that part of the animal the appearance of being marked with a dorsal line. A band of a similar colour descends from each side of the neck to the fore-legs; these legs and also the hind ones are covered with black hairs, and the tail is covered with scales, with a few short and weak hairs thinly interspersed. The hands, that is the prehensile parts of the hind feet, the ears, and the point of the muzzle are naked. The skin on the soles of the feet is violet black; but the toes and nails are flesh-coloured. The whiskers, which appear to be used as instruments of touch, as is the case with all mammalia which seek their prey by night; and it is presumed also, that the toes, which have a very delicate covering, are highly sensitive. The eyes are small, without any external lids, and are remarkable for their convexity and consequent projection beyond their

sockets ; and from this peculiar structure of the eye, it is probable that the animal sees only at short distances, but that its vision there is quite microscopic.



Virginian opossum.

From the structure of the nose it is presumed that the sense of smell is very acute ; but it cannot be very delicate in our way of estimating ; for in that case the animal would be perfectly intolerable to itself, the odour which it emits when disturbed or threatened being described as one of the most offensive in nature. But there is no subject upon which we are more in the dark, and more likely to remain so, than that of the senses of animals. We know the operations of our own senses very imperfectly ; and in the case of smelling in particular, we are unable to say what is the specific difference of affection in our organs, which makes us turn with feelings of pleasure to the odour of roses or of new hay, and shun with pain and aversion that of such an animal as the opossum. Now, if we know little of these matters in our own case, where the pleasure is mental, and, whether we understand its foundation or not, a result of reason and experience, and given us as one of the means by which we are to understand the properties of things, and apply them to our uses in the most pleasing, and at the same time, in the most economical manner for the good of the whole ;—if we are thus ignorant in our own case, where we have something of more importance than the mere animal sensation to guide us, what can we know in the cases of the other animals ? and not knowing, how can we reason ?

Still, this is a subject upon which it is exceedingly difficult for any body to refrain from speculating, and it is nearly, if not altogether, as impossible for any body to be right in such speculations. We are, however, thus far certain, that no animal can feel what we call mental pleasure from sensation, apart from the office which that sensation may supply in the mere economy of the animal. Thus, for instance, there is no material eye, except that of man, which can see beauty in form or in colour, neither is there any nostril, save his, which can scent fragrance, and derive from it those emotions of delight, which we never fail to experience when the healthful breezes come to us

sporting over beds of flowers. But, if we cannot suppose animals have the pleasures of sense, which are mental or supplemental to the mere excitement of the bodily organs, we cannot suppose that they should have the opposite feeling of deformity to the eye, and ungrateful odour to the nose. Upon this principle we can readily perceive that, offensive as the smell of the opossum is to our feelings, it may itself be altogether insensible to that odour which instinct teaches it to give out, probably as its chief means of defence.

In many parts of South America the opossum is so abundant, that it prowls about in the villages, and even in the towns. D'Azzara mentions that they are frequently found lying dead in the villages near the shores of La Plata, and even in the streets of Monte Video. He was the first to get a correct account of the marsupial apparatus of the female, which we shall give in nearly his own words. "The female has the whole length of the belly cleft or slit, and appearing like a person's waistcoat buttoned only at the top and bottom. This cavity the animal has the power of firmly closing. Within it are thirteen teats, extremely small, one in the centre, and the rest ranged round it."

Before the female comes to maturity, this marsupial apparatus is but little developed, there being only a slight fold of skin on each side the abdomen. After the young are weaned, the marsupium also collapses, and it is gradually reproduced as the time approaches when it is to receive a new litter. There seems indeed to be, so to speak, an alternation of the two systems of gestation in these curious females. The uterus is the place where impregnation is effected, and where the germ is developed, at least in its early stage ; but as this takes place when they are in a much more rudimental state than any young animals which pass at once from the uterus to an external mammary system, there is a degree of excitement required in the marsupial apparatus which is not needed in the case of those animals which produce their young comparatively mature, and capable of taking the teat at intervals as nature requires. The perfect marsupial animals, or those which have the internal and external periods of gestation pretty nearly of the same length, remain on the teat, like any moveable excrescence, until they are completely developed ; and it has been ascertained, that in some of the species at least, there is a sort of umbilical cord which connects the young with a sort of placental substance in the body of the teat, until it acquires its form and some of its functions as an animal, at which time it breaks this second connection with the mother, or is born a second time, now an independent animal, capable of drawing milk from the teat, and in due time of finding its food. But this second gestation in the marsupium is clearly as essential to the perfect development of the animal as the first gestation in the internal uterus ; and we can no more imagine an opossum to come to maturity, if it enjoys only the first, and has not its full time in the second, than we can imagine the untimely birth of any other animal to become mature.

This is a most extraordinary piece of nature's economy, and a part, the design of which we are unable, in the present state of our knowledge, to comprehend, and yet it is one which very powerfully and pressingly tempts us onward to inquire.

Now, we perceive that this double gestation, by means of the internal uterus and the abdominal pouch, stands as it were midway between the single internal

gestation of the ordinary mammalia and the internal elaboration of the egg, and external, and we may say unconnected evolution of the chick, by the process of incubation, in birds. The common mammalia require the internal warmth, protection, and action of the mother, with perfect exclusion of the atmosphere from contact with the body during the whole time that the foetus is coming into form. The bird requires that the egg shall be matured in the ovary and oviduct of the mother; but when this is once accomplished, the connection, that is, the material connection, as conveying substance from the one to the other, is cut off for ever as between the parent bird and the future chick, which is still a formless embryo in the egg; so that the egg may be hatched, for the evolution of all the necessary membranes and vessels, and the chick itself may be brought forward by the heat of another bird, or by any heat, if properly applied. We have therefore a second life, as it were, in the young bird, in the action of which the parent bird has no necessary concern; and, if placed in favourable circumstances, by the exclusion of atmospheric air and the light, we know not for what length of time the egg of a bird might not be preserved with the principle of life within it, ready to be called into action by the necessary stimuli, and capable of restoring the species again to the world, even though, by any catastrophe, all the ancestors of the egg were swept away. It is not so, however, with mammalia, for they would necessarily perish, not only with the individual, but with any circumstance which might affect the internal health of the mother during the period of gestation.

The marsupial animal is intermediate between these; and we may reasonably suppose, that as the second stage of its progress in organisation takes place externally of the mother, and partially exposed to the atmosphere, we may very naturally conclude that this marsupial foetus, being in less intimate connexion with the system of its mother than an uterine one, must not be so subject to suffer with the sufferings of her system, but that the mother, with the young in the marsupium, must be able to undergo greater privations, and bear greater hardships, than the uterine mother. We know, also, from the observed fact, that a marsupial mother can bring forward not only two, but perhaps three successions of progeny at the same time. There have been found some in the internal matrix, and some others in the marsupium, so differing in size and development, that they must have been the products of separate impregnations. No doubt, we have cases of superfœtation among uterine animals, as, for instance, in the common hare, but the authenticated ones are very few in number; they are probably all referrible to the category of "monstrosities of habit" which take place in animals, as well as monstrosities of form; and, at all events, they form the exception, and the rare exception—not the rule. During marsupial gestation, on the other hand, reimpregnation is so common, as to be the rule, and not the exception; and it accords with the economy of nature that such should be the case. There is, therefore, evidently an absolvement of the system of the marsupial female from what would be called the labour of maturing the succession, at that very time when this labour falls most heavily upon the uterine mother, and renders her more helpless than at any other state of her mature and undecayed existence.

Hence we see that the marsupial animal is fitted for contending with, and triumphing over, hardships

which the common mammalia could not so well endure; and if, having found this power in the animals, we can discover a corresponding occupation for this power in the countries where such animals are found, or in the situations in which they have to preserve their lives and find their livings, then we are in possession of two elements which will enable us to approach at least to the outworks of this the most impregnable point in the whole physiology of animated nature.

Now, it will not fail to occur to every reader, who has the slightest general acquaintance with the economy and relative distribution of productions on the surface of our earth, that the three grand localities, or, strictly speaking, the two only, for New Holland and the Oriental Isles, and south-eastern peninsula of Asia, may be considered as one great district, which is cut off from much migration of land-animals by the intervening seas, but over which birds migrate with the changing monsoons in numbers, which to us, lying as we do at the outskirts even of the migration of Europe, Western Asia, and Africa, would be perfectly incredible, if we did not know the fact from the most undoubted authority; it will readily be seen, that this tract, and also the eastern side of America, which, from the great cordillera of the Andes running near the west coast, comprises by far the greater part of the continent, are countries beyond all others stocked with tree birds; and not only this, but that, generally speaking, quadrupeds, with the exception of these animals, are few, and of only trifling dimensions. Australia, which, from the dryness of its surface at one season, and the torrents in which rain falls at others, may be regarded as having the extreme character of this species of country; and the quadrupeds there, with a few very trifling exceptions, are all marsupial, whether they feed on animal matter or on vegetable, and whether their chief prey be sought on trees or on the ground. In South America the character is less extreme, but still it is not less of a tree-bird country than any part of the East, at least in those regions which are covered, as much of it is covered, with extensive and luxuriant forests. The changes of season are very great in all those countries; and therefore, the labour which the animals have in finding their food is sufficient to account for the absolvement of the females from that portion of systematic labour in bringing their young to maturity which we have seen that they enjoy. This is not the place for entering fully into the question; but as all the principal genera of marsupial animals occur in the order of the alphabet before the general article MARSUPIATA, we shall collect the leading points of the evidence in the particular articles, which will enable us to sum them up more briefly, and with a better chance of being understood, than if we brought a question so curious and so complicated into one article. We shall therefore now resume our notices of the species *Didelphus*.

The CRAB-EATING OPOSSUM—*Didelphus Cancrivora*. This animal has more the figure of a rat than the former. Its forehead is nearly straight, and its muzzle much pointed. The general colour of the head is white, with a few scattered bristly hairs, as whiskers, on the upper lip and on the posterior part of the cheek, and one or two over each eye; the eyes and ears are also black, which form a striking contrast with the general white colour of the face and head. The ground colour on the neck, the back, and sides, is yellowish, sprinkled or grizzled with black and

white, the black hairs being shorter than the yellowish, and the white ones longer, but with a portion of black at the points. These long hairs form a sort of line along the back, and when the animal is excited, it has the power of erecting them. The legs and feet are wholly black, with the exception of the last joint and the claws, which are white; the tail, which is covered with scales and very short hair, is black at the base, and white for more than two-thirds of its length toward the tip. It is tapering to the end, and prehensile.



Crab-eating opossum.

This animal is remarkably low upon the legs. Its whole length is about thirteen inches, exclusive of the tail, and its height not above six inches, while, from its applying the whole length of the hind feet to the ground, and having the fore ones short and crooked, it is much lower at the shoulders and the crupper than at the middle of the back. It has been observed principally on the warm shores of South America, where it resides in the holes of the rocks above water, and seeks its food chiefly off crabs and other crustaceous animals. Its hind feet are well adapted for grasping, like hands, and its fore paws, which have sharpened crooked claws, and the toes much divided, are also good prehensile instruments; but, in addition to these, it is said to render its tail available, by thrusting it into the holes which the crabs inhabit, and drawing them forth to their destruction.

The **FOUR-EYED OPOSSUM**—*Didelphus Opossum*, is the only other known species which has the marsupium fully developed. Like the former, it is an inhabitant of the warmer shores of South America, but it is a more inland animal, and its food is different. It is rather smaller than either of the former, being about a foot in length, with the tail about one foot two inches. Its head is pointed, the whole of the profile forming a straight line. The ears are large, round in their form, and very thin in their substance.

The prevailing colour in the upper part is reddish brown, mixed with grey on the back, but purer on the head. On this dark colour there are placed two circular spots of white in front of the ears, and it is from these two spots that the animal gets the name of four-eyed, just as some breeds of dogs in this country get the same appellation from two brown spots on a black ground immediately over the eyes. The under part is dull white; a small portion at the root of the tail is covered with the same hair as the upper part of the animal, while the remaining part of that organ is nearly naked and scaly. The female has six or seven teats in the pouch, and in these animals there is a different arrangement from the teats of common mammalia; in them they are arranged in pairs right and left, while in these marsupial animals there is one central, and the others surrounding.

The *Opossums* which have no pouch inclosing and concealing the teats, are smaller than those in which the females are furnished with that appendage; but, though the teats are exposed, the young are placed upon them, and adhere and grow there in a manner not very different from those which are enclosed in the pouch; and the abdomen is supported by marsupial bones in a similar manner. This circumstance shows that the pouch, that is, the external duplicature of the pouch, is not the essential part, but merely a protecting membrane; for it does not appear that the species that are without it carry their young with more difficulty than the others.

The **MEXICAN OPOSSUM**, or **CAYOPOLIN**—*Didelphus dorsigera*. This species is about seven inches and a quarter in length; the eyes and surrounding spaces are brown, there is a line of the same colour up the middle of the face, and the sides of the head are brownish ash. All the upper part of the body is greyish yellow, and the under side yellowish; the ears are surrounded with yellow at the base, and the tail is spotted with brown and yellow, having a part near the insertion covered with hair, and the remainder naked and scaly. This is the species which is described under the name of the slender-tailed opossum by some naturalists.

The **MARMOT OPOSSUM**—*Didelphus murina*. This species is less than the larger of European rats.—It is the murine opossum of Pennant and Shaw; and though smaller in size, it does not differ greatly in its general appearance from the species just mentioned. The muzzle is rather more pointed, the ears rounder, and the head more convex; the eyes are situated in the middle of a transverse band of black, which is broader above than under their openings, and does not extend far beyond their openings laterally.—The upper part of the body is a mixture of fawn and ash colour, the under part is whitish, but with a mixture of fawn which is gradually less and less conspicuous as it approaches the central part of the abdomen. These little animals are, however, subject to very considerable variations in the colour of their attire; and they have, on this account, sometimes been described under different names. The females are furnished with about fifteen teats, situated among the folds of skin in the groins; and the young ones, after they are discharged from the uterus, adhere firmly to these, like little round buttons, until they acquire the developed form of organised animals. The power of adhering to the mother is very wonderful in all the marsupial animals, but more especially in those which are not provided with a developed pouch; and after they have acquired some form, and are detached from

their permanent connection with the teats, these little animals may be observed holding on by the sides and legs of their mother, with a firmness that would not be expected in creatures which are apparently so small and so helpless. The species now under notice are inhabitants of the woods, in which they prey upon very small animals; and the mother may be seen with ten or a dozen little ones, riding on her sides or back, and she holding them on with her prehensile tail while she moves from branch to branch.

THE THICK-TAILED OPOSSUM—*Didelphus macroura*. This is a species considerably larger than the former, and though it has hitherto been described as a native of Paraguay, it is probable that, like the rest, it may be pretty generally distributed over the warmer parts of America. It is larger than the species last described, being about eleven inches in length. The tail is very thick for so small an animal, being not less than three inches in girth at the root. It is covered with hair of smooth texture for the first third, and the remaining two-thirds towards the tip are scaly, and it is all black, except an inch and a half at the point, which is of a white colour. The upper part of the body, the under part of the head, and round the eyes, are bright cinnamon brown; the face and the feet are of the same colour, but deeper. The cinnamon colour in the female is brighter than that in the males. The teats of the female are contained in an elliptic fold, and there are frequently more on one side than on the other. This species is said to be a little more energetic in its characters than some of the rest of the genus; but its manners, like those of most of the others, are imperfectly understood.

SHORT-TAILED OPOSSUM—*Didelphus brachyura*. This is a very small species, not exceeding five or six inches in length, and with the tail only about two inches and a half. It is understood to be that which is described by Buffon under the title of the *Touan*. The upper part of the body is blackish; the cheeks, throat, flanks, and inside of the thighs and paws are bright red; and the centre of the under part pure white. The female has not fewer than fourteen teats situated in the folds of the groin, which are absorbed when she ceases to suckle. The odour which the male emits, when irritated, is described as being very unpleasant. In some parts of the country these animals live in holes of the ground, which they dig for themselves, but in other situations where the surface is different, and there are hollow trees, they burrow in these.

***Delphinus pusilla*.** This species, though named by authors, and particularly described by D'Azzara as his No. 6 of these curious animals, is not so clearly established as most of the others. It is described as being about seven inches in length, exclusive of the tail, the last three inches of which part is naked and prehensile. A circle round the eyes is black, with white markings of the eye-brows, separated by a triangular spot of a dusky hue. The general colour of the body is that of the shrew, or a sort of dark mouse colour; it is described as inhabiting near the dwellings of the Indians in Paraguay, and throughout the greater part of the valley of La Plata, and having many of the characters of a common field-rat or mouse, at the same time that it retains the marsupial structure and characters, and the general appearance of the rest of the genus.

Such is a brief outline of most of the particulars which are known respecting the appearances, habits, and localities of this genus generally, and also respect-

ing the individual species of which it is made up. In an economical point of view they are animals of small value, though the foetid odour of the living animal does not extend to the flesh, which is eaten by the Indians; but in a natural history point of view, they are far more interesting and important.

DIDERMUM (Savigny). A genus of molluscs united to the genus *Synoicum* of modern authors.

DIDYMOCARPÆÆ. See CYRTANDRACEÆ.

DIGITALIS (Linnæus). A well-known genus of European herbs, some of which are biennials, though the chief part are perennials. Linnæan class and order *Didynamia Angiospermia*, and natural order *Scrophularia*. The foxglove is common on every hedge-bank, and no wild plant is more ornamental than this. In the gardens there is a white variety, though this is also found wild in some places. Two plants, namely, *Isoplexis Canariensis*, and *I. sceptrum*, were formerly ranked among the foxgloves, but are now separated by Dr. Lindley. All are easily propagated by seeds.

DIGITARIA (Scopoli), is the common finger-grass of Britain, and elsewhere.

DILATRIS (Linnæus). A genus of greenhouse perennials from the Cape of Good Hope. Class and order *Triandria Monogynia*, and natural order *Hæmodoraceæ*. Generic character: calyx corolla-like, of six petals, hairy without, and regular; stamens six, inserted in the base of the calyx; three of them short and sterile, and three long; style filiform; stigma simple; capsule three-celled; seeds three or six peltate. The bulbs or tubers of this plant thrive best in sand and leaf-mould, and are increased by offsets or seeds.

DILL. Is the *Anethum graveolens* of Linnæus, and is cultivated as a pot or sweet herb in gardens: it belongs to the same family as the fennel, so much used as a sauce for mackerel, &c.

DILLENIA (Linnæus). A beautiful and large forest tree, a native of India, named in honour of J. T. Dillenius, once botanical professor at Oxford. It belongs to *Polyandria Polygynia*, and gives a title to one of the Jussieuan orders, viz., *Dilleniaceæ*.—Generic character: calyx of five, leathery, persisting sepals; petals five, and somewhat leathery; stamens very numerous, inserted into the receptacle; anthers oblong and erect; style none; stigmas level, persisting, and disposed in a circle; berry many-seeded and many-celled. This is one of our first-rate stove plants, and may be propagated by cuttings, or, which is better, by imported seeds, sown as soon as they arrive in this country. Mr. Sweet observes of this plant that the leaves are so delicate, that tobacco smoke, or a temperature below sixty degrees of Fahrenheit, injures them very much.

DILLENIA CÆÆ, a natural order of dichlamydeous dicotyledonous plants, containing sixteen known genera, and about one hundred species. It is closely allied to *magnoliaceæ*, from which it is distinguished by the want of stipules and the quinary arrangement of the parts of fructification. It also bears an affinity to *Ranunculaceæ*, but differs in its habit and in its persistent calyx.

The essential characters of the order are: perianth with an imbricated æstivation; sepals five, persistent, two exterior and three interior; petals five, deciduous in a single row, hypogynous; stamens numerous, hypogynous, arising from a torus, either distinct or polyadelphous, and either placed irregularly round the pistil or on one side of it; filaments filiform, dilated

either at the base or apex; anthers adnate, two-celled, the cells generally opening longitudinally and internally; ovaries definite, more or less distinct, with a terminal style and simple stigma; fruit consisting either of from two to five distinct unilocular carpels, or of a similar number cohering together, the carpels being either berried or two-celled; seeds ovate, arranged in a double series at the angle of the carpels or cells, two or many, sometimes solitary, surrounded by a pulpy arillus; testa hard; embryo minute, lying at the base of fleshy albumen.

The plants belonging to this order are: trees, shrubs, or under-shrubs. Their leaves are almost always without stipules, alternate, rarely opposite, commonly coriaceous, with strong veins running straight from the mid-rib to the margin. Their flowers are solitary, in terminal racemes or panicles, and often of a yellow colour. The greater part of these plants are found in New Holland. Some of them grow in India and in the southern parts of America and Africa.

In general they possess astringent properties.

The order has been divided into two distinct sections: 1. *Delimaceæ*, or *Delimeæ*, including the genera *Delima*, *Tetracera*, *Davilla*, &c., in which the filaments are filiform, dilated at the apex, and bear on each side a round distinct cell of the anther. 2. *Dilleneæ*, comprehending the genera *Dillenia*, *Hibbertia*, *Pleurandra*, *Candollea*, *Colbertia*, &c., in which the filaments are not dilated at the apex, and the anthers are elongate and adnate.

The genus *Dillenia*, whence the name of the order is derived, furnishes six known species, some of which are applied to useful purposes. *Dillenia speciosa* is a splendid tree, forty or fifty feet high, found in the forests of Malabar and Java, which bears beautiful yellow flowers, larger than those of the water lily, and yields a pulpy acid fruit, the size of a large apple.

The tree has a thick stem and rugged bark, and when wounded discharges an astringent watery fluid. The calyx of this species, as well as that of *Dillenia scabrella*, when in a young state, has an agreeable acid taste, and is used in curries by the inhabitants of some parts of India.

Hibbertia volubilis is a green-house plant, well known for the beauty of its flowers and the peculiar fetid odour which they emit. *Hibbertia dentata* is a very ornamental green-house plant, and is admirably adapted for trellis; when supported with a stake, it will reach the height of six or eight feet, and has a beautiful appearance with its rich yellow flowers, which continue to expand during all the summer months.

Decoctions of the leaves and bark of *Davilla rugosa* and *elliptica* are used in Brazil as astringent washes for wounds and ulcers, and are applied to swellings of the legs which often occur in warm countries.

The leaves of *Delima sarmentosa* and several other species of that genus are so covered with asperities, that they are employed in China in place of a file, and are used for polishing furniture.

The fruit of many plants of this order when mixed with water is used in India as an acidulated drink in fevers.

DILLWYNIA (Smith). A genus of Australian evergreen shrubs, consisting of above eleven species, all introduced since 1794. They are decandrious plants, and belong to *Leguminosæ*. Generic character: calyx of two lips, and five-cleft; corolla standard

broad, unequally two-lobed; petals and stamens inserted in the middle of the calyx; style crooked; pod bellied, two-seeded; seeds like a string of beads. These plants thrive in moor-earth, and require well drained pots. Cuttings root freely in sand.

DILUVIUM. A term employed by geologists to describe one of the principal deposits which is found on the surface of our globe. A diluvial soil owes its existence to the violent action of water, or some other powerful agent operating for a considerable length of time on masses of the hardest bodies. Thus we find the most compact rocks, such as basalt, worn away and converted into an impalpable powder by natural processes, and at other times great blocks of granite removed from their earth-bound sites, and carried to distant plains, where such masses could not originally have been placed.

DIMERA (Latreille). In the first edition of the *Règne Animal*, the curious little family of coleopterous insects *Psclaphidæ*, was raised to the rank of a section under this name, from the incorrect observation of the tarsi, which were supposed to be only two-jointed. As, however, the observations of more recent authors proved them to be at least three-jointed, the section has been suppressed in the late works of Latreille.

DINETUS (Sweet). A genus of climbing plants, annuals, and perennials. They are pentandrious, and belong to the natural order *Convolvulaceæ*. Generic character: calyx in five parts; corolla bell-shaped, in five equal erect segments; stamens as long as the corolla, filaments joined to the tube; anthers roundish; style bifid; stigma headed; seed-vessel two-celled, four-seeded. The perennial species are increased by cuttings; the annual species are either greenhouse or open air plants, climbing quickly and producing flowers in autumn. This genus was formerly called *Porana* by Burmann, but separated by the late Mr. Sweet.

DIOCTRIA (Meigen). A genus of dipterous insects belonging to the family *Asilidæ*. (See this article under that of *BOMBYLIDÆ*.) The antennæ are placed upon a peduncle with the terminal style minute, and the basal joint longer than the following. The body is also long and narrow. They fly with great strength, and some of the British species have the wings black, and glossed with blue, which gives them a very exotic appearance. Their habits are similar to those of the *Asili*.

DIODON—globe fish. A genus of fishes belonging to the order *Plectognathes*, and family *Gymnodontes*, an account of which will be found under the last of these words.

DIOMEDIA (Cassini). A West Indian genus of evergreen shrubs, bearing yellow compound flowers, formerly ranked among the *Buphalmums* by Linnaeus. These plants have silvery leaves, grow in light compost, and are propagated by cuttings.

DIONÆA (Linnaeus). This genus of plants consisting of only one species, is found in Carolina in North America. It belongs to *Decandria Monogynia*, and to the natural order *Droseriaceæ*. The flowers are by no means striking, but the foliage is most remarkable, not only in form, but for its irritable properties, and consequent spontaneous motion. Each leaf is composed of three parts; a lower principal leaf, with two leaflets at its end. The leaflets are somewhat semicircular, and articulated close together upon a gland-like body at the point of the principal, as already stated. The articulations act like hinges, permitting the leaflets to fall back from each other, and remain in a nearly hori-

zontal position. While so spread open, should a thirsty or honey-seeking fly, or other insect, venture between the leaflets so as to touch the gland, they instantly start up together with considerable force, and clutch the prisoner; nor can the intruder easily extricate itself, because the inner edges of the leaflets are furnished with opposing ranks of short bristles, which shut into each other like the teeth of a rat-trap; so that a fly has no means of escape, more especially as the leaflets do not open again for many hours. The same motion is produced by touching the gland with the point of a straw or other body.

Some naturalists are of opinion that this extraordinary mechanism of the plant is a provision for supplying itself with putrified animal food; and have gone so far as make the plant catch morsels of raw beef or mutton, with a view to fattening, or increasing its volume. Nay, more, that the plants so feasted grew the better for it!—but this requires confirmation.

The vulgar name of the *Dionæa* is “Venus’s fly-trap;” it is a low inconspicuous marsh plant, and, when cultivated in nurseries for sale, is planted in bog-earthly turf in a pot kept constantly in a pan of water, as the plant must never be allowed to get dry; but by no means should it be ever flooded. Whether kept in a greenhouse or frame, they should have a hand-glass placed over them, to ensure a more equable degree of moist air: at the same time fresh air is necessary, the hand-glass never being kept quite close.

DIONYX (Dejean). A curious genus of minute coleopterous insects, belonging to the family *Pselaphidæ*, allied to *Stenists*, but having the labial palpi armed laterally with several spines; the antennæ have the four last joints very long. A single specimen of this curious insect has only yet been discovered: it was captured by Dejean, on the wing, in the evening, in the department of Aude, during his military campaigns.

DIOPSIS (Linnæus). A genus of dipterous insects, belonging to the great family *Muscidæ*, and distinguished from every other dipterous genus by having the eyes and antennæ placed at the extremity of horny slender footstalks, rising from the sides of the head, and being in some species as long as the entire body, which gives these insects a very remarkable appearance. They are of great rarity, and seldom found in collections. They inhabit the tropical climates of India and Africa, and but little is known of their habits. Above a score distinct species are described in a monograph upon the genus, published in the last part of the Transactions of the Linnean Society.

DIOSCOREA (Linnæus). A genus of herbaceous plants, some few of which are eminently useful to the inhabitants of the countries where they naturally abound. Linnæan class and order, *Diœcia Hexandria*, and natural order *Dioscoreæ*; Generic character: perianths superior, six-cleft, persisting; stamens inserted into the base of the perianths: filaments awl-shaped; anthers two-celled; styles simple; capsule triangular, three-celled, in each two compressed winged seeds. The *D. alata* is the yam of India. The tubers are as large as a child’s head, rough and black exteriorly, but when boiled, remarkably white and mealy within, and very little inferior to the best potato. They affect light sandy land; and in some of the East-India port towns, may be had in considerable quantities for ship’s stores, which keep well for a month or two on board ship. In our hot-house collections they are grown in light soil, and

trained up to stakes or upon a trellis, and are increased by parting the roots. These, however, are never cultivated for use.

DIOSCOREÆ, the yam family, a natural order of monocotyledonous plants, containing five or six known genera and upwards of fifty species. It is nearly allied to *Smilacæ* in structure and habit, but differs in the character of its ovary, its capsular fruit, and in its albumen, having a large cavity. In many respects it approaches the dicotyledonous structure.

Its essential characters are: flowers diœcious; perianth six partite; in the sterile or male flowers there are six stamens inserted into the base of the segments of the perianth; in the fertile or female flowers, the ovary is three-celled, each cell containing one or two seeds; style deeply trifid; stigmas undivided; fruit leaf-like, compressed, with two of its cells sometimes abortive; seeds flat, compressed; embryo small, included in a large cavity of the cartilaginous albumen, near the hilum.

The plants of this order are twining shrubs, with alternate, occasionally opposite leaves, which are generally reticulated with veins, as in the dicotyledonous plants. The flowers are small, spiked, and have from one to three bracteas.

They are found in tropical countries in both hemispheres, and possess in general mucilaginous and nutritive properties.

The chief genera of the order are, *Dioscorea*, *Rajania*, *Testudinaria*, *Oncus*, and *Æchma*. *Tamus*, or the black bryony, which was formerly included in this order, is by Loudon and others referred to a distinct order, called *Tameæ*.

Dioscorea furnishes numerous species which are found in the East and West Indies, and in North and South America. They are commonly known by the name of yams, and are interesting as furnishing large fleshy, sweet tubers, which are considered an important article of food in all tropical countries.

Dioscorea sativa, the common yam, is largely cultivated in the West Indies, where it serves for food to the negroes. It yields large thick tubers a foot broad, which have a mealy taste, and are esteemed nutritive and easy of digestion. They are eaten instead of bread, either roasted on the embers or boiled. The flour got from them is made into puddings. The flesh of the yam is white or purplish and viscid, but becomes farinaceous and mealy when dressed. The fresh juice of the root is acrid, and excites itching on the skin. There are many varieties of the root. *Dioscorea aculeata* is by some looked upon merely as an improved variety of the common yam. It is extensively cultivated, and yields tubers which are frequently three feet long, and weigh thirty pounds. All the edible species and varieties of *Dioscorea* are propagated in foreign countries like the common potato, but they arrive much sooner at maturity. They are planted in August, in rows two feet apart, and eighteen inches distant in the rows, and they are ripe in November or December.

Testudinaria elephantipes, common elephant’s foot, is a native of the Cape of Good Hope, and is frequently cultivated in green-houses in this country. This plant has a singular appearance on account of its large fleshy root, a foot in diameter, which rises above ground and is covered with angular brown knobs having a tessellated aspect. The name *testudinaria* is derived from the resemblance between this root and the clumsy shell of some huge tortoise. The term

elephantipes, or elephant's foot, has also been applied on account of the remarkable appearance of this root-stock. The stem of the plant is slender and climbing, and presents a remarkable contrast to the root. The flowers are small and insignificant. The Hottentots, in time of scarcity, use the fleshy inside of the root as a sort of yam.

DIOSMEÆ—The Buchu family. A natural order of dicotyledonous plants, containing nearly twenty genera, and upwards of one hundred and twenty known species. It is closely allied to *Rutaceæ*, and by many botanists is considered merely a section of that order. It differs, however, in the peculiar structure of its fruit, and in having two ovules in each cell. It also bears an affinity to *Xanthoxyleæ*, *Simarubaceæ*, *Humiriaceæ*, and *Aurantiaceæ*.

The essential characters of the order are: flowers hermaphrodite, regular or irregular; calyx consisting of four or five divisions; petals as many, distinct or united, rarely wanting; aestivation generally twisted, convolute, rarely valvate; stamens equal to, or double the number of the petals, sometimes, by imperfection, fewer, hypogynous, or rarely perigynous, placed on the outside of a disc or cup surrounding the ovary, and either free, or combined with the base of the calyx, or sometimes wanting; ovary sessile, stalked, its lobes equal to the number of petals, or fewer; ovules twin and collateral, or one above the other, very rarely four; style single, sometimes divided at its base into as many parts as there are lobes of the ovary; stigma simple or dilated; fruit consisting of several capsules, either cohering firmly, or more or less distinct; endocarp, or internal skin of the fruit, entirely separating from the sarcocarp (or fleshy matter under the skin), which opens internally by two valves; the endocarp also two-valved, the valves opening at the base, but connected by a membrane which bears the seeds; seeds twin or solitary, with a testaceous integument; embryo with a superior radicle, which is either straight or oblique; no albumen.

The plants belonging to this order are trees or shrubs, rarely herbs. They are furnished with exstipulate, opposite, or alternate simple or pinnate leaves, which are covered with pellucid resinous dots. Their flowers are axillary or terminal, and of a white or reddish colour.

The greater part of them inhabit the tropical parts of the globe. They are found abundantly in the warm regions of America, at the Cape of Good Hope, and in New Holland. A single genus is found in the south of Europe.

By some authors this order has been divided into sections according to the countries in which the plants are found. Thus we have, first, the European section, including the genus *Dictamnus*, found in the south of Europe; second, the Cape section, including the numerous species of *Diosma*, *Adenandra*, &c., found at the Cape of Good Hope; third, the Australasian section, comprehending the genera *Boronia*, *Phebalium*, *Correa*, *Eriostemon*, &c., found in New Holland and Van Diemen's Land; and, fourth, the American section, including the genera *Evodia*, *Galipea*, &c., which grow in South America, the West Indies, New Zealand, the Friendly Islands, and Mexico. To this last section are referred the *Cuspariæ* of Decandolle. This division of the order, according to the geographical distribution of the plants, is found to agree most remarkably with the character of their fructification.

In general the plants of this order abound in essential oil, and possess aromatic, tonic, and antispasmodic properties. Many of them have been used in medicine.

The genus *Diosma*, or Buchu, furnishes upwards of seventy species, almost all of which are natives of the Cape. They have a powerful and offensive odour, which is nevertheless relished by the Hottentots. Many of them have been recommended as antispasmodics and tonics.

The leaves of *Diosma crenata* (*Barosma crenulata* of recent authors) resemble much those of senna, and are used in medicine under the name of Buchu leaves. They have been introduced into the Dublin Pharmacopœia. They emit a strong aromatic odour, have a pungent taste, and yield by distillation a volatile oil. They possess diuretic and tonic properties, and have been recommended in the form of infusion and tincture in some diseases of the bladder. Their activity seems to be owing to the volatile oil and resin which they contain. *Diosma ericoides* and other species are used by the Hottentots to scent the ointments with which they anoint their skin.

Galipea, or *Cusparia febrifuga* (*Bonplandia trifoliata* of Willdenow), is a handsome South American tree, and yields the well-known Angostura or Cusparia bark. This bark occurs in commerce in pieces from six to twelve inches long. It is of a fawn colour, and is covered with a whitish rough epidermis. When powdered, it exhibits a yellowish brown hue. It has an aromatic, bitter, and somewhat astringent taste. According to analysis, it consists of einchonia, and a small quantity of brucia, combined with igasuric acid, muriate of ammonia, gum resin, extractive and volatile oil. The term Angostura bark is derived from the common name of the town of St. Thomas, near the Straits of the Orinoco, whence it is exported; while Cusparia is derived from the native name of the tree. A spurious kind of cusparia bark is sometimes met with in commerce, which possesses poisonous properties, and appears to be the product of a species of strychnos. The epidermis of this false Angostura bark is covered with rust-coloured warty excrescences; its powder is of a very light yellow, and it has neither the odour nor the aromatic flavour of the true bark. The lichens which grow upon it, and the effect of different chemical agents, are also sufficient to distinguish it.

Angostura bark possesses all the tonic properties of Peruvian bark, and is used as an aromatic bitter in stomach complaints, as well as in intermittents and dysentery. It is frequently combined with rhubarb, magnesia, and carbonate of potass, and is prescribed in the form of powder, infusion, or tincture.

Evodia febrifuga, *Ticorea febrifuga*, and *Hortia Brasiliana*, yield barks which are used in Brazil in the cure of intermittent fevers.

The root of *Dictamnus albus*, or *Fraxinella*, has a bitter aromatic taste, and was formerly used medicinally as a sudorific and vermifuge. This plant abounds so much in volatile oil, that the atmosphere surrounding it actually becomes inflammable in hot dry weather.

DIOSPYRUS (Linnæus). Is the date-plum, a genus of trees and shrubs, indigenous to many different parts of the world. Linnæan class and order, *Polygamia Diœcia*, and natural order *Ebenaceæ*. In our collections they are placed in the stove or greenhouse, and are in these places treated like other plants. The hardy ones are seen in our shrubberies,

and grow to good-sized shrubs. Some of the species are cultivated for their fruit in the eastern parts of Asia, and the *D. ebenum* yields the valuable timber called ebony.

DIPLOLEPIS. A name introduced by Geoffroy for the gall-flies, which Linnæus had previously termed *Cynips*. The former name, notwithstanding its incorrect application, having been adopted by the French entomologists, has occasioned much confusion between these insects and those of the family *Chalcididæ*, which Geoffroy misnamed *Cynips*. See the articles *CHALCIDIDÆ* and *CYNIPIDÆ*.

DIPLOPTERA (Latreille). A division of stinging hymenopterous insects, comprising the various species of wasps, and distinguished by having the upper wings folded longitudinally when at rest. The antennæ are generally elbowed and thickened at the tips: the eyes are notched on the inside. The collar is produced behind on each side as far as the base of the wings, the upper pair of which have two or three closed submarginal cells; the body is smooth and polished without hairs (as in the bees) and, generally, of a black colour, more or less spotted with yellow or brown. The character upon which this division is founded, and from which it received its name (doubled wing), is one of those curious instances where we find a peculiarity of organisation which cannot, so far as we are enabled to perceive, have the slightest influence upon the habit of the species, and yet it is so constant that we look in vain throughout the whole of the extensive order *Hymenoptera* for any other instance of folded wings except in the group in question: and yet, if we look at the habits of the species, we find them to be sufficiently diversified to induce us to suppose that we might here find sufficient cause for such a marked peculiarity: but this is not the case. Thus, we find the *Odyneri* perfectly resembling the *Crabronidæ* and *Cercerides* in the economy of burrowing into sand and wood, in order to form the cells in which they lay up a provision for their progeny, which are to be hatched from eggs deposited at the same time with the food; whilst, on the other hand, in the *true* wasps, we have a social economy, similar to that of the hive.

The *Diploptera* then, in respect to their habits, form two groups; but Latreille has established two sections from the structure of the antennæ, which in the first (*Masarides*) have the terminal joints soldered together, so as to form a club; whereas in the second (*Vespides*), including both the *Odyneri* and *Vespæ*, the antennæ have the joints distinct and composed, as usual, of thirteen joints in the males, and twelve in the females.

DIPLOTHEMIUM (Martius). Is a genus of Brazilian palm, to which country it is confined; nor is its history much known.

DIPPER—*Cinclus*. A genus of birds belonging to the *dentirostral* division of Cuvier's great order *Passeres*, and to the thrush family in that order. The singular appearance and very peculiar habits of these birds render them objects of much attraction, not merely to professed ornithologists, but to all who are fond of observing the children of nature in their wild state. Accordingly these birds have received a great many popular names; and systematists have been as much puzzled, in what part of their artificial cabinets to give them a place. The fact of these birds having separate names in both the ancient and both the modern languages, which are spoken in Britain, is sufficient to prove the attention which they must have attracted

even at a very early period. This bird is the *Mwy-alchen y dwfr* of the Welsh, and the *Gobha uisge* of the Scotch Highlanders; in England it is the water ouzel, the penrith ouzel, the water crake, the water crow, the water colly, and a variety of other names; and with the Scotch it is the water pyet, the water craa, and various other names. In fact, in this country alone, it has got as many names as might suffice for a tolerably well-stocked aviary.

The generic characters are, the bill of mean length, sharp in the cutting edges, straight, elevated in the culmen, rounded at the extremity, and with the point of the upper mandible bent over that of the lower. The nostrils are lateral at the base of the bill, longitudinal, and in great part covered with membrane. There are three toes to the front and one to the rear; the tarsi are short, but longer than the middle toe. The wings are short and rounded, the first quill being short and merely a supporter to the second, and the third and fourth the largest in the wing. It is doubtful whether there is any more well made out species than one. Several have indeed been mentioned, but without sufficient grounds, as it should seem; and that which is mentioned as being an inhabitant of the peninsular Crimea on the north of the Black Sea, and named after Professor Pallas, by Temminck, differs from that met with in this country only in the colour, being all over of a rich, reddish brown, while our one is pied. The habits of the two are, however, described as being so nearly alike, and so little is known of the one named after Pallas, that a description of the one which, though not common in any part of Britain, is pretty widely distributed over it, will suffice for popular purposes.

Cinclus aquaticus, the dipper, is very generally dispersed over Europe, seems capable of enduring all climates, and is understood to be resident all the year round in most of the localities in which it inhabits. With us, it may be described as being chiefly a mountaineer; but it is not so on many parts of the continent, for it is found in Holland, in Jutland, and in many of the comparatively flat districts on the south of the Baltic and in Russia. It is also met with in the south, as in Spain, Italy, and the island of Sardinia, being particularly abundant by the banks of the smaller streams in the Pyrenees and the Alps. It is not, however, confined to the south and middle parts of Europe, for it is met with in the Faro islands, and it is not improbable that it may occur in Iceland. It occurs also in northern and central Asia, from Siberia to the north of Persia, though, from the habits about to be described, it is not found in the dry deserts.

The dipper bears some resemblance in its general shape to the common wren, only the tail is shorter in proportion. The whole length, if we take the average of full-grown birds, is about eight inches, the stretch of the wing about ten or eleven, and the weight about two or three ounces. The colours are, the head and back part of the neck amber brown; the back and scapulars black, but with blackish grey on the margins of the feathers; the throat, a small patch on the eyes, the sides of the neck, and the upper part of the breast, white; the lower part of the breast and the rest of the under part of the body is chestnut-brown, passing into dark brown nearly black toward the vent, and having the under tail-coverts of nearly the same grey as the margin of the feathers on the back. The bill is blackish brown; and the tarsi and toes grey, sometimes inclined more to yellow, and sometimes to

blackish blue. The female is very like the male, except that the head is darker brown, and the white on the breast dull coloured. The young are grey on the head and part of the back, and have more white on the breast, but it is broke by mottlings, and they have also some white on the margins of the wing-feathers.



Dipper.

These birds breed early in the season, and construct their nests in general with a great deal of care. The nest is formed under a projecting stone in a hole of the rock, or even in a hole of the wall, if the situation is sufficiently retired and near the water. This nest usually consists of a great quantity of materials, generally vegetable, as the stems and leaves of aquatic plants, dry moss, and the leaves of trees; but the structure is differently described by different authors, and may be different in different circumstances and under different exposures. Of course we do not know the instinct which leads birds to build nests differing so much from each other as they are in different species, or indeed what leads them to build nests at all; but as they must in some manner be regulated by circumstances, they will, of course, make their structures in accordance with these. If the nest is immediately under a projecting roof, it is natural to suppose that though the bird might give it a dome in a more exposed situation, it might be satisfied with a natural one where that presented itself. The eggs are described as being four or five, of a pure white colour, semi-transparent, long in their shape, and very much pointed at their small ends. This is sufficient to show that there is not much philosophy in an opinion sometimes advanced, that the form of the egg bears some analogy to that of the bird; for the dipper is in every way a short bird in its body, its wings, and its tail. The young dippers are ravenous eaters; and the nest with young in it is easily detected by their chirping.

Dippers are with us found only in the streams of hilly countries, which run over beds of sand or gravel, and have their waters clear and transparent; and it is an especial frequenter of those little pools between the rapids, where trouts resort to deposit their spawn.—The spawn of fishes, their fry, when young and in the breeding pools, and water insects, are understood to form the chief subsistence of the dipper; and as this kind of provisions is found more early in the season than almost any other food for an animal feeding bird, the dipper is enabled to find food for its young sooner in the year than those birds which resort

to the hill and the brake in those localities. Indeed, though it is confined to the margins of streams, and to those of streams of a particular character, and therefore not distributed in breadth over any part of the country, the dipper runs less hazard from famine than most other birds, except in severe winters, when it is frozen out. This, too, is a circumstance of rare occurrence in most of the haunts of the dipper; because, in most of those localities in which it delights, which are the dells of the secondary hills, not far from the low country, but always above those places at which the bottom begins to be oozy, and the water turbid with mud, there are always springs breaking out from such a depth as that they seldom freeze; and there are many little animals which intrust their young to such springs, and thus, in case of necessity, furnish the dippers with food until the frost breaks.

If the rivulet is open, the dipper is perfectly independent, because it can procure its food under the water as readily as on the bank. It is true that it is not web-footed, and consequently it is not a swimmer, neither are its general characters those of a water bird. Still it is a bird which can turn the water to great account, and it seems to know this as well, for it is apparently never happy but when the water is immediately within its reach, and always happy when it is so. It is seldom seen at any great distance from its favourite rivulet; and when it is found at some little distance it is timid, as if it were without the security of that which forms its castle. When, however, it is near the water, it is far from being a shy bird; but, though it is very easily seen, it is by no means easy to catch.

Its usual action when sitting on the points of the little pieces of rock and detached stones in the pools, consists of a continual bending down of the head, and a flirting up of the tail at the same time; and it is from this peculiar motion of the head, and not from the fact of its getting into the water, that it is called the dipper. From the shortness and broadness of its wings, and the compactness of its body, it gets very quickly into flight, and it skims along the surface of the water, almost touching with its wings at every stroke; and, when flying in this manner, it appears to get on more rapidly and with less fatigue than when it is higher above the surface. It is highly probable that all birds which have this habit of skimming along the surface of the water, find a relief in so doing, not only from the cooling, but from the greater resistance which is there offered to the down stroke of their wings, from the difficulty with which the air escapes from between the wing and the water.

The dipper can get under water with great facility, and walk along the bottom, and probably also come to the surface, and take wing from the water; though in general it comes to the bank for this purpose. Its plumage is very waterproof, and it is never wetted or ruffled by these immersions, one of which would effectually prevent the flight of any ordinary land bird. It has sometimes been objected to this under-water habit of the dipper, that as it cannot swim on the surface like the aquatic birds properly so called, or run on the surface like some of the long-toed birds, it cannot get below, because it is specifically lighter than the water, and has no purchase of the feet from which to thrust itself down; but the dipper turns its head and its wings to very good account in performing this operation. The dipping motion of the head gets that part under water; and the wings are partially under water at the same time. Then the elevation of the head,

and the raising of the wings, converts these into levers for the depression of the body; and by this means it gets very speedily under water,—so speedily, indeed, that it appears to run down the bank to the bottom with no more apparent effort than what is necessary for simple progressive motion. When it is overhead in the water, the wings, and partially also the head are used with great neatness and effect; and the upward stroke of the wings, even in that case, serves to keep the body to the bottom against any difference of gravitation there may be between the bird and the same bulk of water. In this way it can pick up and even pursue its food below water as easily as a common ground bird can do on the surface of the earth; and as, when below the surface, it always holds the wings recovered, that is, at such a distance from the body as that they can strike first either upwards or downwards, it can move with equal celerity in any direction. This need excite no surprise; for though wings are not the usual instruments of motion below water, yet the difference between the wings in the air and in the water is more a question of their being proof against the action of water than of any thing else, because in the matter of specific gravity, it requires no very great degree of mechanical acumen to perceive, that it is not more difficult for a bird, by muscular exertion, to keep itself down in a fluid specifically heavier than itself, than it is to keep itself up in a fluid specifically lighter; and, as the difference between the specific gravity of the dipper, and that of water, is really less than the difference between the specific gravity of any bird and air, the dipper has an easy task. We forgot to mention that the dipper is a sort of songster in the early part of the year, though not a very melodious one; yet it is cheerful to hear a bird sitting on a stone in the brook and singing, when the banks of that brook are covered with snow. The summer note is a mere chirp.

DIPSACEÆ. The teasel or scabious family, a natural order of dicotyledonous plants, containing eight genera, and nearly one hundred and twenty known species. It is closely allied to *Compositæ*, but differs in its distinct stamens and pendulous albuminous seeds. It also bears an affinity to *Calyceræ*, from which it is distinguished by its free anthers and inverted embryo. It bears likewise a relation to *Valerianææ*, but differs in its habit, its capitate flowers, and in having an involucellum. By these characters it is also separated from *Caprifoliaceæ*.

Its essential characters are: calyx superior, membranous, resembling pappus, surrounded by a scarious involucellum. (This involucellum is a peculiar organ, resembling an external calyx, and may be said to correspond in some degree with the partial involucre of the *umbelliferæ*.) Corolla monopetalous, tubular, inserted in the calyx; limb oblique, four or five lobed, with an imbricated æstivation; stamens usually four, inserted into the tube of the corolla, alternate with its lobes; anthers distinct, two-celled; ovary inferior, one-celled, with a single pendulous ovule; style filiform; stigma simple, longitudinal or capitate; fruit dry, indehiscent, one-celled and one-seeded, crowned by a pappus-like calyx; albumen fleshy; embryo straight, radicle superior.

The plants belonging to this order are herbs or undershrubs, with opposite or verticillate leaves, and densely capitate flowers, which are surrounded by a many-leaved involucre.

They abound in the south of Europe and north of Africa. Some are also found at the Cape of Good

Hope and the Levant. In general they shun cold, and do not reach a great elevation above the sea.

Their properties are not deserving of much attention. Many of them are bitter and tonic, some are used on account of their astringency in dyeing, and a few possess febrifuge virtues.

The chief genera of the order are *Dipsacus*, *Scabiosa*, *Knautia*, *Morina*, and *Pterocephalus*.

The genus *Dipsacus*, or teasel, includes thirteen species, of which three are natives of Britain. *Dipsacus fullonum*, fullers' teasel, is so called on account of being used in dressing cloth, for which purpose the hooked scales of its receptacle are admirably adapted. These are fixed round the circumference of a large broad wheel, which is made to revolve, while the cloth is held against them. By long cultivation in a poor soil, the hooks of the receptacle are said to disappear. By some botanists this species is looked upon merely as a variety of *Dipsacus sylvestris*, or the common wild teasel. *Dipsacus pilosus*, small teasel, is the handsomest species. Its seeds are eaten by small birds. The axils of the leaves of the common teasel usually contain a quantity of limpid water, which is sometimes very acceptable to travellers.

The genus *Scabiosa*, or scabious, includes sixty-one known species, only two of which are natives of Britain.

Scabiosa succisa, Devil's-bit scabious, is common in meadows and pasture land. It derives its name from the circumstance of its root being as it were cut or bitten off abruptly. It is said to yield a green dye, and also to be sufficiently astringent for tanning.

Scabiosa atropurpurea is rather a handsome species, bearing dark purple flowers, and is cultivated as a border annual or biennial. The leaves of *Knautia arvensis*, common field scabious, have a sharp and rather bitter taste, and were formerly recommended in cutaneous diseases.

DIPSACUS (Linnæus). A genus of European herbs, one of which is the well-known clothiers'-brush, or teasel, found wild as well as cultivated in England. It belongs to the fourth class and first order of Linnæus, and gives a title to an order in the natural system, namely, *Dipsaceæ*. Some of the species are admitted into the flower-garden, and are raised from seeds. The cultivated teasel is, like the rest, a biennial, and is sowed in drills, and kept clean and thinned by the hoe in the first year; in the second, the plants are also kept clean, and when the heads are ripe, they are cut for sale.

DIPSAS (Leach). A genus of molluscs now forming a subdivision of the genus *ANODON*, under which it is described.

DIPTERA. An order of insects belonging to the great division *Haustellata*, or those furnished with a tubular proboscis, and distinguished by the presence of only a pair of membranous extended wings affixed to the centre of the sides of the thorax, and generally furnished near their insertion with a pair of short clubbed organs, termed halteres or balancers, respecting which, as analogically representing the posterior wings of the four-winged insects, entomologists are at variance; the mouth is provided with a sucker composed of from two to six scaly lancet-like pieces, and enclosed in a canal upon the upper surface of a fleshy proboscis, or covered by one or two inarticulated plates which serve as a sheath (*Hippobosca*). The body is composed, as in the other six-legged insects, of three principal divisions representing the head, thorax, and abdomen. The ocelli, when present, are generally three in number; the antennæ exhibit various

degrees of development, from the exceeding length in the *Macroceræ* and *Megistoceræ* to the scarcely visible size in the *Hippoboscæ*. In the *Tipulidæ* we find these organs composed of numerous articulations.



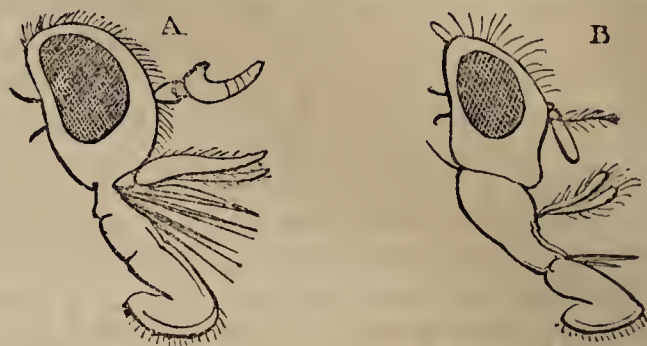
A, Antennæ of *Tipula*; B, of *Tabanus*; C, of *Musca*.

In the *Tabanidæ* and *Beridæ* they are very short, and the terminal articulations become almost indistinct, so that in the *Muscidæ*, &c., where they are very short, and appear to be composed only of three joints, having a terminal bristle, it is impossible not at once to perceive that the terminal joints are, with the exception of those composing the seta, so entirely soldered together that their union is not visible. The eyes are lateral, and in many instances those of the males are much larger than in the females, uniting upon the crown of the head. In others they are so large as to occupy nearly the entire head, leaving but a small space only for the mouth.

In those species which have the mouth more perfectly developed than the rest, and which consist of the blood-thirsty gnat and gadfly, we find a series of organs, greatly modified of course as to their form, in order to fit them for their functions, but which, as to their number, correspond with those of the mouth of the true mandibulated insects, so that it is equally impossible for us to arrive at any other conclusion than that the parts of the mouth of the fly represent, in an altered state of development, the parts of the mouth of the beetle. We accordingly find that the mouth in *Tabanus* consists of a large fleshy organ, having a fleshy pair of lobes at its extremity, and which, being the lowest part of the mouth, corresponds with the lower lip of the beetle. At the sides of this, and rather higher in the mouth, is attached a pair of lancet-like organs, having a pair of large biarticulate palpi arising from the base,—these constitute the maxillæ and the maxillary palpi. Still higher in the mouth another pair of lancets appears, which represent the mandibles, whilst a larger horny piece, channelled beneath for the reception of the others, and which forms the upper lip (*labrum*). Within the mouth another very fine lancet appears, analogous to the tongue of the grasshoppers, an organ seldom developed to any extent in the *colcoptera*. When we consider the habits of these insects, it is evident how necessary it is that the organisation of the mouth should be fitted for a different employment from that of masticating. These habits are essentially suctorial, and the food of the insects is essentially fluid; broad horny organs would therefore be useless, whereas a series of acute instruments for puncturing and penetrating deeper and deeper into the food, and a fleshy canal, up which, by suction, fluids easily pass, is what would exactly be looked for in the workmanship of an omniscient and all providing Artificer.

In other groups of dipterous insects, and more especially in those which prey upon their companions (*Asilidæ*, *Empidæ*, &c.), we find diminished forces

in the organisation of the mouth, the lancet-like mandibles have vanished, but all the remaining organs appear in full development. In the *Syrphidæ* the maxillæ become smaller, and in *Musca* they are



A, Mouth of *Tabanus*; B, of *Musca*.

completely lost. In the *Æstridæ* the entire mouth is sometimes completely obliterated. The legs are generally long and slender: some instances occur when then are disproportionately long, whilst in others they are more or less thickened and spined. The wings agree in their veining with the anterior pair of the *Hymenoptera* rather than with those of the *Neuroptera*, only there are fewer transverse nerves. In one group however, *Nemestrina*, the wing is reticulated nearly as much as in the *Neuroptera*. In comparing the upper wing of a bee with the wing of a fly, no particular resemblance is to be traced between the direction and position of the veins, but if both the front and hind wings of the bee be compared together with the wing of some flies, as the *Syrphidæ*, and particularly *Aphrites*, we are enabled to trace a very great resemblance between them in this respect. M. Macquart employs this circumstance as a forcible argument in support of the opinion that the balancers of the *Diptera* do not represent the lower wings of the bee. The uses to which these balancers are applied are not yet decidedly ascertained; the insect moves them with extreme rapidity, especially when a buzzing noise is produced, and it is important to observe that they are placed close to the mouth of a pair of the breathing pores. Many species are moreover provided at the base of the wings behind with a pair of membranous doubled organs, somewhat like the valves of a shell, which are termed *alulets*; one of these is attached to the wing, and the other to the sides of the thorax. The size of these alulets is in inverse proportion to that of the *halteres*. The abdomen is generally attached to the thorax by a portion only of its basal diameter, it is composed of from five to nine visible articulations, and is generally pointed at the extremity of the females, enabling them the more readily to introduce their eggs into the situations in which they are deposited. In those species which have the abdomen composed of the fewest segments, those which appear to be wanting are transformed into a kind of ovipositor, consisting of a series of little tubes sliding one into another like a telescope. The sexual organs of the males are external in many species, and folded beneath the abdomen. The legs are terminated by a tarsus consisting of five joints, the last of which is armed with two small claws, and very often with two or three membranous lobes or pulvilli. It is by the assistance of these terminal organs of the foot that the fly is enabled to perform the curious mechanical feat of walking with the back downwards, against gravity, upon the ceilings of rooms, highly polished glass, &c. From the experiments of Sir Everard Home, it has been generally considered that this was effected by the formation of a vacuum, by means of

the close application of the margins of these soles of the feet as we may term them, and the subsequent muscular raising up of their central parts; but the following remarks by one of our most acute modern observers, Mr. Blackwall, published by him in the Appendix of the last volume of the Linnæan Transactions (in correction of a memoir previously published by himself, in which he had adopted the vacuum system), will be read with interest, as showing what interesting sources of inquiry are opened to the student of nature, even in the commonest objects of the creation.

In experimenting upon the house-fly, he observed that individuals *frequently remained fixed* to the sides of an *exhausted* glass receiver after they had entirely lost the power of locomotion, and an evident distension of the abdomen had been occasioned by the exhaustion of the aëriform fluids it contained. To detach them from these stations, the employment of a small degree of force was found requisite.

"In prosecuting this subject, clean phials of transparent glass, containing spiders and various insects in the larva and imago states, capable of walking on their upright sides, were breathed into, till the aqueous vapour expelled from the lungs was copiously condensed on their inner surface. The result was remarkable; the moisture totally prevented those animals from obtaining any effectual hold on the glass, and the event was equally decisive if a small quantity of oil was substituted for the aqueous vapour. A similar consequence ensued, also, when the flour of wheat, or finely pulverised chalk or gypsum, was thinly strewn on the interior surface of the phials, the minute particles of those substances adhering to the tarsal brushes of the spiders, the pulvilli of the perfect insects, and the under side of the feet of the larvæ. These facts, far from corroborating the mechanical theory, appeared quite inexplicable, except on the supposition that an adhesive secretion is emitted by the instruments employed in climbing. The next point to be determined, therefore, was, whether spiders and insects in the larva and imago states, when moving in a vertical direction on clean glass, leave any visible track behind them? Careful and repeated examinations, made with lenses of moderately high magnifying powers, in a strong light, and at a favourable angle, speedily convinced me that my conjecture was well founded, as I never failed to discover unequivocal evidence of its truth, though, in the case of the spiders, considerable difficulties presented themselves in consequence of the exceedingly minute quantity of adhesive matter emitted by the brushes of those animals. On submitting this secretion to the direct rays of the sun, in the month of July, and to brisk currents of air, whose drying power was great, I ascertained that it did not suffer any perceptible diminution by evaporation under those circumstances. Now, it is reasonable to infer, from the foregoing researches, that the hair-like appendages constituting the brushes of spiders, and occurring in such profusion on the inferior surface of the pulvilli of insects, are tubular."

The larvæ of the diptera, as well as the perfect insects, have characters peculiar to themselves. In many of these larvæ the head is of a fleshy substance, without any determinate form, whilst in the majority of the larvæ of other orders the head is horny and consistent in form. The breathing pores have also a peculiar disposition; instead of

being placed in pairs upon the first, fourth, and following segments of the body, as is generally the case, the anterior pair are found upon the second segment, whilst all the rest, from two to eight in number, are brought together upon the terminal segment. Those larvæ, which are constantly footless, or but rarely provided with fleshy appendages, have the mouth armed with two points formed for piercing the matters upon which they feed. In the transformations which these insects undergo in their passage to the perfect state, there is less diversity than in the organisation of the perfect insect. Insects in general are oviparous, but there are of course exceptions to this rule, and two of the most remarkable are to be found in this order. We have already, in our article upon the BLOWFLY, detailed one of these exceptions, in which the eggs are hatched in the body of the parent, and produced in a living state. The other occurs in the forest-flies (*Hippoboscidae*), in which group not only are the eggs hatched within the body of the female, but the larva there acquires its full growth, and assumes the pupa state, being ejected from it in the shape of an egg as large as the abdomen of the parents, and from which the perfect insect, instead of the larva, makes its escape.

The larvæ of the diptera in general offer so great a simplicity of structure, as to cause an uniformity of appearance; nevertheless, those which reside in the water are more diversified in their characters, being furnished with organs of nutrition and respiration very unlike those of the terrestrial larvæ; for an account of which we must refer to our articles upon CHIRONOMUS, CULICIDÆ, CORETHRA, &c.

In passing to the pupa state, these larvæ employ two principal modes. In the greater number there is no shedding of the skin; the skin of the larva hardens, contracts, and becomes an oval cocoon, within which the pupa is disengaged, appearing at first merely as a gelatinous mass, but afterwards exhibiting in some degree the different parts of the perfect insect, the eyes and wings being folded upon the breast. In the others the metamorphosis is effected by the larva shedding its skin, and the insect then appearing in the form of an inactive incomplete pupa, like that of the former, but not inclosed in a cocoon. In some of the latter, as in the aquatic species, the pupa retains its activity, jerking about with much agility in the water, whilst many are quite inactive.

In their perfect state, the insects of this order are scarcely less numerous, in point of *species*, than any other order of insects; but, if we look at them with respect to the number of *individuals*, we find them infinitely to exceed any other. The clouds of midges, for instance, rising at eventide over the marshes, like the incense of the Temple, equally pay homage to the Divinity, in showing forth His mighty power; whilst myriads of flies of every kind are to be found in every quarter of the globe, traversing plants and every animate object, and more particularly all that has ceased to live.

This immense profusion with which they are dispersed over the globe causes them to fulfil two very important functions in the economy of nature; first, they serve for food to a vast number of the higher animals. Charged with a Divine mission by Him "who giveth food to the young bird," the swallow and the sparrow destroy them by myriads, and the

fly-catcher and the humming-bird alike find in them a constant shedding of manna; whilst, on the other hand, they cease not in effecting the disappearance of all substances in a state of decomposition, both animal and vegetable. They are universal scavengers; and so great is their activity and the rapid succession of their generations, that Linnæus might well say that three flies can consume a horse as fast as a lion. Amongst such a vast number of objects, it is not surprising that some should be found obnoxious to ourselves or our properties. Many species, accordingly, cease not to make man their prey, by sucking his blood, whilst some either attack our cattle in like manner, or deposit their eggs upon their bodies, within which the parasitic larvæ feed; others deposit their eggs, or young, upon our food and upon our growing corn.

Many species reside in woods, in meadows, marshes, and in our habitations, others move with dancing feet upon the spray of the waves, and even upon the snows of the polar regions. Many are attached to plants, upon the flowers of which they abound, sucking the honeyed sweets, without giving the preference to any particular plant, whilst some are confined to a single species of flower; but it is upon the star-like anthesis of our meadows that the majority seem to revel with the greatest delight. During the summer and autumn the flies are attracted to our orchards, in order to destroy our fruits, whilst some species delight in the honey dew of the aphides, or the fluids which escape from the wounds of trees. The domestic fly alike feeds upon all kinds of household provisions; and other species, which so closely resemble it in size and appearance as to deceive an ordinary observer, are parasitic upon the nests of various solitary bees. Nothing, indeed, can be more amusing than to watch one of the latter following the laborious insect, the young of which she is about to supplant by her own, peering about into the mouth of the nest, and cautiously making her entrance, in order to deposit her own eggs, when the bee has, with great toil, completed her nest, and deposited her store of honey-paste for the food of her own progeny.

The order was established by Aristotle, the great father of zoology, under the name which is still retained for it; and since the days of Linnæus, by whom its distribution was attempted, various naturalists have contributed to raise it to the rank which it has now attained, although it has not been a general favourite with our amateurs. It is to Reaumur and De Geer that we are indebted for our knowledge of the transformations of many of these insects; whilst Fabricius, Latreille, Meigen, Fallen, Wiedemann, Robineau des Voidy, and Macquart, have successively established families, tribes, genera, and species; the works of Meigen and Macquart having especially contributed to this end.

The following is the arrangement proposed by the latter in his valuable "Histoire Naturelle des Diptères," published during the present year, and which we have adopted, with this variation only, namely, that, with Latreille and Leach, we have considered the forest-flies as forming a primary section of the order, whereas M. Macquart has placed them merely as a family of the great group of *Muscidæ*.

Section I. (*Ovipara* or *Larvipara*; DIPTERA, Leach.)

Head distinct from the thorax; sucker enclosed in a labial canal; claws of the tarsi simple, or with one tooth; the transformation to the pupa state not taking place within the body of the parent.

Division 1. (NEMOCERA). Antennæ having six or more distinct joints; palpi with four or five joints.

Fam. 1. (*Culicidæ*). Sucker with six lancets.

Fam. 2. (*Tipulidæ*). Sucker with two lancets.

Division 2. (BRACHOCERA). Antennæ having three distinct joints; palpi with one or two joints.

Subdivision 1. (*Hexachæta*). Sucker with six lancets. Fam. *Tabanidæ*.

Subdivision 2. (*Tetrachæta*) Sucker with four lancets.

A (Fam. *Cænomyidæ*, *Beridæ*, *Stratiomydæ*.)

B (Fam. *Mydasidæ*, *Asilidæ*, *Hybotidæ*, *Empidæ*, *Henopidæ*, *Nemestrinidæ*, *Bombyliidæ*, *Anthracidæ*.)

C (Fam. *Therevidæ*, *Leptidæ*, *Dolichopidæ*, *Syrphidæ*.)

Subdivision 3. (*Dichæta*). Sucker with two lancets. This subdivision comprises an immense assemblage of species, constituting the Linnæan genera *Æstrus*, *Conops*, and *Musca*, after the removal of the *Syrphidæ*; but, owing to the numerous divisions and subdivisions necessary for its investigation, having but little to interest the general reader, we shall not here detail them.

Section II. (*Pupipara*; HOMALOPTERA, Leach).

Head immersed in the front of the thorax; sucker enclosed in two valves; claws with many teeth. The transformation to the pupa state undergone in the body of the parent fly.

Fam. 1. (*Hippoboscidæ*). Head frontal.

Fam. 2. (*Nycteribiidæ*). Head dorsal.

DIPTEROCARPEÆ—the camphor tree family.

A natural order of dicotyledonous plants, containing only a few genera and species. It is closely allied to *Elæocarpeæ*, but differs in its petals not being fringed, and in the want of albumen. It bears also an affinity to *Malvaceæ*, from which it is distinguished by its stamens being either distinct or only partially combined, by its long narrow two-celled anthers, and its pendulous ovules. To *Guttiferæ* it has also some affinity, but it is separated by its stipules and the contorted æstivation of its corolla. This order may be at once recognised by the enlarged leafy and unequal segments of the calyx while investing the fruit. Its essential characters are: calyx tubular, five-lobed, unequal, without bractæas, and imbricated; petals sessile, combined at the base with a twisted æstivation; stamens indefinite, distinct, or imperfectly polyadelphous; filaments dilated at the base; anthers awl-shaped, two-celled, opening longitudinally towards the apex; ovary superior, few-celled; ovules in pairs, pendulous; style and stigma simple; fruit coriaceous, one-celled, indehiscent or three-valved, surrounded by the enlarged foliaceous calyx; seed single, without albumen; cotyledons twisted and folded, or unequal and obliquely incumbent; radicle superior.

The plants of this order are large and elegant forest trees abounding in resinous juice. Their leaves are alternate, involute, with numerous parallel veins running from the midrib to the margin. They have deciduous oblong stigmas which terminate the branches in a taper point, and their flowers are generally large.

They are found only in the eastern islands of the Indian Archipelago.

This order, though small, is important on account

of the resinous juice which it furnishes. Its properties may be said to be stimulant and balsamic.

The chief genera of the order are, *Dipterocarpus*, *Dryobalanops*, *Shorea*, and *Vateria*.

Dryobalanops Camphora is interesting on account of yielding the camphor of Sumatra. In that island this tree is confined to the country of the Battas, which extends about one degree and a half to the north of the equator. It is also found in Borneo in nearly the same parallel of latitude. The camphor is found in a concrete crystallised state in fissures and cavities in the interior of the tree. It is less volatile than the common camphor of commerce, which is the product of *Laurus Camphora*, a native of Japan and China. On account of its scarcity it bears a very high price. It is little known in this country, or even in Europe. An oil is procured from the camphor tree by incision, which is supposed to be the first stage of the formation of camphor.

An account of camphor and its medical uses will be given under the article LAURINEÆ.

Shorea robusta affords a balsamic resin, which is used in the Indian temples.

By boiling the fruit of *Vateria Indica*, a tree common on the Malabar coast, a kind of tallow rises to the surface which concretes on cooling. It is whitish, greasy to the touch, and has rather a disagreeable odour. It is extremely tenacious and solid, but melts at the temperature of $97\frac{1}{2}^{\circ}$ Fahrenheit. In the town of Mangalore it is sold for about twopenny halfpenny a pound.

DIRCA (Linnæus). A small deciduous shrub, native of Virginia, in which country it is called leatherwood, perhaps from the toughness of the fibres of the inner bark. The flowers are inconspicuous, are octandrous, and the plant belongs to the natural order *Thymelææ*. It is usually planted among North American plants, and is propagated by layers.

DISA (Bergier). A genus of curious flowering plants, natives of the Cape of Good Hope. Linnæan class and order *Gynandria Monogynia*, and natural order *Orchidææ*. These plants thrive best planted in a pit with other Cape bulbs or tubers, in soil composed of loam, moor earth, and sand. They only need water when in a growing state.

DISCINA (Lamarck). This genus of molluscs has been so called from each valve presenting, near the centre, a remarkable and very distinct orbicular disk; that on the superior or upper side is smooth and pierced, exhibiting in its centre a small papillary elevated summit, giving it much the appearance of a patella: it is also surrounded by a margin longitudinally marked with delicately radiating striæ. The disk of the lower margin is very white, obliquely crossed by a notch or cleft, open on both sides. Although the valves of the shell are of an equal size, they are not exactly similar, the upper one being rather more convex, and the lower without striæ round its disk: there are no traces of hinge, ligament, or muscular impressions visible. It is found on the British coast affixed to stones. Sowerby observes this genus should be entirely expunged. Lamarck having constituted it from examples of the *Orbicula*, without mature consideration, it therefore must now form a subdivision of the genus *Orbiculina*.

DISCOBOLUS, so called from the ventral fins, forming a disk on the under part of the body, by means of which the fishes are enabled to hold on upon the points of rocks, and there catch their food, which

is brought to them by the currents. They form the third family of Cuvier's soft finned fishes, with the ventrals under the pectorals. They are fishes of small size, and altogether uninteresting for economical purposes. They are, however, curious on account of their form, and of the habit which we have mentioned. There are only two genera in the family, and the species are not numerous.

LEPADOGASTER—the Sucker. The members of this genus are very small fishes; their pectoral fins are very large, and reach the middle of the under part. They are composed of very strong rays, a little divergent in the front, and united by a membrane which is elastic, and which also includes the ventrals. Their bodies are smooth and without scales, the head depressed, and the muzzle projecting and capable of distension. Their gill openings are small, with four or five rays in the gill-flap. They have one soft dorsal fin immediately over the anal. Their intestinal canal is short, straight, and without those appendages, which would show that they are animal feeders. They have no air bladder, notwithstanding which they swim with considerable rapidity. There are several species found in the European seas, and on the British shores; but on the south and west rather than the east. The following are the British species.

L. CORNUBIENSIS—the Cornish Sucker, is about four inches in length, and reddish, with dusky spots. When full grown there are two eye-shaped marks behind the eyes, with a brownish marginal ring, a bright purple disk, and a small spot of intense blue in the centre. There are also four little fleshy filaments in front of the eyes, and the snout is produced, rounded and flattened. They are met with on the coast of Cornwall, and also in some parts of the Hebrides; and there is no doubt that if they were of any value to the fishermen they might be found upon all the rocky shores which are washed by the Atlantic, especially where a current of tide sweeps along. They are met with at low water adhering to the rocks, by means of their disk.

L. BIMACULATUS—Two-spotted Sucker. The length of this species is only about an inch and a half, and the body is more slender and the snout more pointed than in the former, and it is furnished with no appendages in connection with the eyes; the general colour is pink spotted with white; and when mature there is a spot of purple with a white margin behind each pectoral fin. This species is found in the Channel, and does not appear to be so decidedly a current fish as the other; but it adheres to stones and shells. These two species have the dorsal and anal fins distinct from the caudal; but there are several species which inhabit the Mediterranean which have these appendages united. There is nothing, however, in their history which can particularly interest the general reader.

CYCLOPTERUS—Circular Fin. The most remarkable structural character of this genus is that from which it is named. The ventral fins are united into one disk, which surrounds a considerable portion of the under side, forming a very efficient sucker, by which they can fix themselves firmly to rocks, to the bottoms of ships, or to the bodies of the larger fishes. Their mouths are large, and furnished with small pointed teeth in both jaws, and also in the pharynx. Their gill openings are small and closed below, with six rays in the flap. Their pectoral fins are very large, and they are continued and united under the throat,

in front of the disk formed by the pectorals. Their bones are soft, and their skin viscous and without scales; but it is sprinkled with minute grains of a hard substance. Their stomachs are very large, their intestines long and abundantly furnished with cæca, characters which indicate habits very different from the former genus, with which they have sometimes been confounded.

DISPERIS (Swartz). An orchideous genus from South Africa, which succeeds, if potted, or planted in a pit in compost made of a mixture of loam and peat earth.

DISPORUM (Salisbury). A genus of perennial herbs from China and Nepal. Class and order *Hexandria Monogynia*, and natural order *Melanthaceæ*. Generic character: corolla of six petals, bell-shaped, nectariferous holes at the base of the segments; stamens under the germen; filaments very short; style abbreviated; stigmas three-capsuled, three-valved; seeds membranous. According to Sweet, these plants are hardy enough to stand on a warm border, if sufficiently defended from frost.

DIURIS (Smith). A genus of curious plants from New Holland, belonging to the natural order *Orchideæ*. They are much easier cultivated than the South American species of the same order; only requiring to be potted in moor-earthly soil, and kept in a pit or green-house safe from frost.

DIURNA (Latreille). A section of lepidopterous insects, corresponding with the Linnæan genus *Papilio*, or butterflies, being distinguished by having the margin of lower wings not furnished at the base with a scaly bristle for retaining the upper wings in their proper situations, these, as well as the second pair, being generally perpendicularly elevated during repose; the antennæ are generally terminated by a club, and the larvæ have sixteen legs. The perfect insect, always furnished with a spiral tongue, flies by day, and the under surface of the wings is not less beautifully variegated than the upper. Having, under the article **BUTTERFLY**, entered at length into the natural history of these beautiful insects, we shall here simply give a slight sketch of their distribution into groups, established upon their diversities of structure.

Fam. 1.—*Papilionidæ*. Anterior legs not abbreviated, fit for walking, alike in both sexes. Pupa angulated, suspended, and braeed across the middle. Antennæ not hooked at the tip. Here belong the genera *Papilio*, *Zelima*, *Parnassius*, *Thais*, *Pieris*, *Pontia*, *Colias*.

Fam. 2.—*Nymphalidæ*. Anterior legs abbreviated, not fitted for walking; unguis bifid; pupa angulated, and merely suspended by the tail; middle cell of the lower wings closed. Genera: *Cethosia*, *Argynnis*, *Melitæa*, *Vanessa*, *Libythea*, *Biblis*, *Nymphalis*, &c.

Fam. 3.—*Heliconiidæ*. Pupa smooth, suspended only by the tail; anterior legs imperfect; discoidal cell sometimes open. *Danaïs*, *Heliconia*, *Acræa*, &c.

Fam. 4.—*Lycænidæ*. Anterior legs semi-abbreviated; claws minute; pupa smooth, braced, larva onisciform. Genera: *Polyommatus*, *Thecla*, &c.

Fam. 5.—*Hesperiidæ*. Anterior legs not abbreviated; antennæ hooked at the tips; pupa smooth, braeed, and folliculated. Genera: *Hesperia*, *Thymele*, &c.

These characters, it will be seen, are in some degree

derived from the preparatory stages of the insects; indeed, these considerations afford much more important clues to the classification of insects than they were imagined to possess by the earlier authors upon this branch of natural history. Of those who adopted a contrary opinion, Schrank may especially be noticed. He consulted metamorphosis in its various modifications, in his arrangement, and on its importance as a guide to minor sub-divisions, he has the following ingenious observations, quoted by Dr. Horsfield in his *Lepidoptera Javanica*:—"Metamorphosis, in its larva state, may, and I think must be taken into the characters of the genus, in the absence of other sufficiently distinctive notices. Those botanists who have derived their systems primarily from the fruit, have nevertheless a regard for the flower, and by this means reciprocally elucidate existing obscurities. Caterpillars are the flowers of the lepidoptera. They are, indeed, not always present when the perfect insects are before the examiner. But is the case different with the botanist?" And Mr. MacLeay says to the same effect: "As the knowledge of the whole life of an insect must make us better acquainted with its nature than a mere description of one of its forms, in the same proportion ought metamorphosis to outweigh every other principle of arrangement."

DIVER—*Colymbus*. A genus of web-footed birds, and one of the most aquatic of the whole order. They appear in structure and in habits as literally made for the water, and the water only; and they have equal command of themselves on and under the surface of that element. They are chiefly natives of the northern hemisphere, and of the more northerly seas, being birds peculiarly fitted for contending with the storm in the water itself, and probably getting to a greater depth than that to which the water is disturbed by the waves. They are especially abundant about projecting headlands in the northern countries, where the current runs strong, and the surf and spray occasionally beat with great violence. But amid the turmoil of the storm, the divers appear as much at home in the foaming water as the small birds do in the groves on the gentlest morning of May. In such situations they may be seen driving about, now appearing in the trough of the waves, now boring through the ridges, now on the wing for a little space, but anon plunging into the water. At such times and in such places the fry of fishes, which remain and feed much nearer the surface than such as are full grown, are collected in abundance, and many of them lose command of themselves in the troubled waters, so that they are brought helpless to the line on its slope upon which the wave turns; for it is to be understood that waves do not roll onward in rapid progressive motion as they have the appearance of doing to a spectator, they merely swing in times proportionate to their lengths, that is to half the distance between the bottom of the trough and the top of the ridge, as measured on the slope; and as the turning point, or rather line, taken in the length of the wave, is the place of no upward or downward motion, it is there where the small fishes and other surface animals are accumulated while the storm lasts; and it is to profit by those accumulations that the divers are found driving through the waves on such occasions.

Cuvier makes the divers a family consisting of three genera, the divers properly so called, the grebes, and the guillemots; but as the word diver is in this country restricted to the genus *Colymbus*, and as the

guillemots have some differences of habit, we shall restrict this article to the divers properly so called.

Their characters are: the bill of moderate dimensions, straight, compressed, and very sharp at the point; the nostrils at the base, lateral, oblong, and half closed by a membrane; the legs placed far behind, with the tarsi compressed or flattened sideways; three front toes very long, and webbed to their points, and the hind toes short and united to the inner toe by a rudimental web. The legs are articulated very far backwards and wide of each other, so that though they act powerfully in the water they are very ill adapted for walking on land; and when the birds attempt this, they are obliged to carry their bodies in nearly a vertical position, and roll them along with their steps, which are both short and awkward. The wings are short, but remarkably close in their feathering; and the tail is also very short and rounded. The form of the body is long and flat, the breadth being greater than the depth; and the head and neck are comparatively slender, the former gradually fining off into the strong and sharp bill, which answers equally for seizing the prey or transfixing it by a thrust. The plumage over their whole bodies is remarkably close and compact, and how long soever they remain in the water they are never wetted. They spend the greater part of their time in the water unless when they have nests; and as they are very energetic in their motions, they are very voracious in their eating. They are also very miscellaneous feeders, capturing fish, small marine animals, and not refusing vegetable food if it comes in their way. Their summer quarters are chiefly in the north, where they form their nests upon small islands, or projecting headlands where they are subject to be but little disturbed. Their eggs are usually only two in number, and as is the case with the greater number of sea birds they make no formal nest. It is a fact worth attending to, as showing the difference between depending on the land and depending on the sea, that the eggs of land birds are, generally speaking, much more numerous than those of sea birds, while the sea birds themselves are much more numerous than land birds. Sea birds indeed, though they have at all times considerable labour in the finding of their food, have yet plenty of it at most seasons; and besides, they are exempted from many of the casualties which land birds have to suffer; and not the least of these are the attacks of beasts and birds of prey. From both of these the sea birds are comparatively free, and perhaps they owe some part of their safety to the unpalatableness of their flesh; for many of them are so rank that it is doubtful whether even a starved raven, the least dainty perhaps of animals, would condescend to make a meal of some of them; and as for the sea eagles and ospreys, they are more partial to a fish dinner.

In the divers, the sexes do not differ greatly in appearance; but the young differ so much from the old birds that they have been formed into separate species; and not only this, but as the young require three years before they assume the proper plumage of maturity, and as they continue growing all this time, one species has sometimes been multiplied into four, by giving separate specific accounts of birds of one year, birds of two years, birds of three years, and birds in their plumage of maturity. We shall notice one or two of the leading species.

THE GREAT NORTHERN DIVER—*C. glacialis*. This

is a very large species, and one which attracts a good deal of attention. Its bill is upwards of four inches in length, with a strong ridge or keel above the nostrils, and with the under mandible deepest in the middle, a form which gives much stiffness and power to that part of the organ. The size is subject to considerable variation; but the largest are from two feet and a half to three feet in the length of the body, and from four feet and a half to five feet in the stretch of the wings; and when they are of this size, and fat, they weigh from twelve to fifteen pounds. The head and neck are black, but the neck is surrounded by two white collars freckled with black, the upper part is black powdered with white spots, and the under part white. In winter those birds frequent the northern parts of both continents; but they breed in the marshes, or the fresh water pools, and not on the rocks. We believe few of them nestle on the main land, even in the northernmost part of Scotland; but they are by no means rare in the western islands and the Orkneys, and they are met with in Norway, Sweden, and the north of Europe generally, and also in Iceland and Greenland, and in fact in all the countries joining the Arctic Seas. In their breeding places they love retirement, and their nests are usually concealed among reeds or other tall aquatic herbage. Their eggs bear some resemblance to those of the goose, only they are very slightly spotted with black.



The Great Northern Diver.

To capture the eggs of the great diver, or the young birds, if the mother is near, is a matter of some hazard, just as the finding of the nest and getting at it are matters of some difficulty. It should seem that, in placing the nest, inaccessible ground, as well as concealment, were the object of these birds; for they are generally in places where they can neither be reached in boats nor on foot; and if they are reached, and the old bird is near, she makes a very determined, and at the same time, a very formidable resistance. Her bill

is darted out with nearly as much rapidity as that of a bittern, and as the bird is heavier, the bill thrusts like a bayonet, so that both bird and nest are tolerably well secured from the predatory quadrupeds of those places. In the summer season these birds subsist almost entirely on the smaller species of surface fishes, or the young of the larger ones; and, notwithstanding their size and weight, in the capture of their prey their adroitness is very great. They have equal address in avoiding danger, which renders it very difficult to shoot them on the water; for as they dive, the shot glances, and they are safe. Sometimes, however, they are taken, or rather take themselves, on the baited hooks of the fishermen's lines, and at other times they get entangled in nets at greater depths below the surface than one would be apt to suppose.

In winter they migrate southwards, and on their migratory journeys they are capable of lofty and rapid flight. The young are the most prone to take these excursions; and as they make their way to the inland lakes of France and Germany, and sometimes even as far as Switzerland. The descriptions of these young ones have led to some of the confusion which there is about the species. They are not rare upon some places of the north coast of Scotland in the winter season, but they seldom make their appearance on the English shores unless the winter is very severe.

These birds, and indeed all the diving birds of the Polar seas, are remarkably well defended against the cold to which they are exposed in their dives. Their skins are remarkably strong and tough; and the down upon them among the roots of the feathers is very close. They have also a pretty thick layer of fat all over the body, immediately under the skin. Their skins are so strong, and the down upon them adheres so firmly, that the people of the northern islands dress and tan them, and make of them very warm and durable articles of clothing.

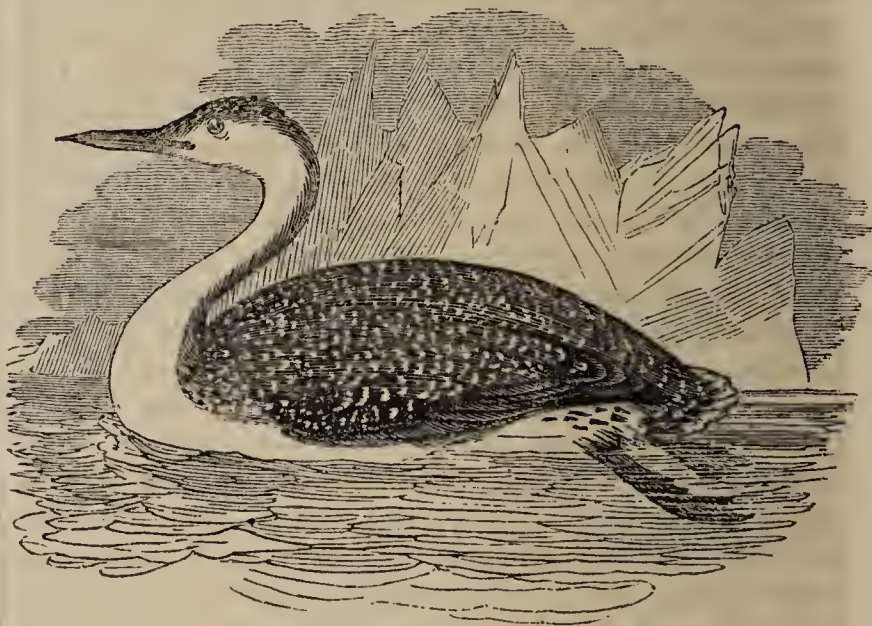
The voice of these birds is strong, harsh, and peculiar, and resembles more the barking of a dog than the sound uttered by almost any other of the feathered creation. They are in short altogether very extraordinary birds.

RED-THROATED DIVER—*Colymbus septentrionalis*. This is a much smaller species than the former, but it is more elegantly made. The length does not exceed two feet, or the weight much more than three pounds. The bill is about three inches long, slender and pointed, of a black colour, and slightly curved upwards. The crown of the head and back of the neck are purplish black with raised white margins to the feathers. The sides of the neck and head and cheeks are dark grey; the upper part is very dark olive with the margins of the feathers paler, and the coverts of the wings dusky with white spots. The front of the neck is brownish-red, from which the name of red-throated diver is derived; the rest of the under part is silvery white with a black bar on the vent. The young differ considerably, not only from the old, but in the different stages in their own growth. At first they are all over dusky on the upper part, and dull white on the under; and next the grey on the head appears, and the back is spotted. The third change which they undergo is the acquiring of the mature plumage, and the reddish brown on the throat.

In some parts of the country, Orkney, we believe, this species is called the rain-goose; because when it screams, or rather croaks, the people of that country say that it predicts rain. It is probable, however, that

there is not very much truth in this prophecy; and yet many birds, both of the land and the sea, are apt to be clamorous before foul weather.

Like the former species, this one breeds in the marshes. It is more abundant in the more northerly of the Scottish islands, and more discursive to the British bays and estuaries in the winter, being found in the Thames, though not very frequently. The eggs of this species are very much elongated, of an olive brown colour, and marked with a few dusky spots. The nest is made with some care of moss and grass, and the female lines it with down from her own breast.



Red-throated Diver.

THE BLACK-THROATED DIVER—*Colymbus arcticus*. This one is a little larger than the former, being about three inches longer, four inches more in the stretch of the wings, and nearly a pound heavier. The front, the throat, the fore neck, and the back and rump are black; the sides of the neck mottled black and white; the sides of the back and scapules black with white spots. The habits agree pretty nearly with those of the others, the nests being also on the margins of lakes; the eggs are also two in number; but unlike those of the last species, they are white. The young are dusky above and white below at the first; the head next becomes grey, and the sides of the head spotted with black; and the last stage of the plumage is the appearance of the black on the fore neck, and the black and white mottlings on the sides of the back and the scapulars.

DIVING WATER SPIDER (*ARGYRONETA*, Latreille), a genus of pulmonary arachnida, belonging to the family *Araneidae*, but forming, according to Walckenaer, a distinct family named *Nayaides*. The four central eyes form a quadrangle, the two lateral ones on each side touching each other, and placed upon a slight eminence; the first and fourth pairs of legs are the longest. The type species *Aranea aquatica* (Linnaeus), is very common, and of a brownish black colour, with the abdomen silky, and with four impressed spots on the back. It resides in slow running waters and ditches, in which it swims about with a bubble of air attached to its abdomen, and spinning a most beautifully constructed web of white silk, in the form of half the shell of a pigeon's egg, or like a diving bell, with the mouth downwards, as its retreat, at the bottom of the water, and which is attached by numerous threads to the surrounding plants. In this it devours its prey, and deposits its bundle of eggs, which

it watches with great care. In this also it passes the winter, having first closed the mouth. The males as well as the females construct these cells.

DOCK. The vulgar name of a British weed called by botanists *Rumex*. Including the different sorts of sorrel, there are nine or ten species of *Rumex* in Britain; the large leaved are called docks, and the small leaved are called sorrels.

DODO—*Didus*. A genus of birds inhabiting, or rather said to have inhabited, the island of Madagascar, but which is now extinct, and indeed the existence of it at any time, as answering to the descriptions which are given by the older writers, is somewhat doubtful. The first description, or rather the only one which even pretends to be founded on actual observation, was given by the Dutch, when they first visited that part of the world; and of which an oil painting was made about the same period. The description and a copy of the painting were given by Cluseus in his account of exotic birds; the picture was also copied by Edwards; and from these sources the bird got into the popular books as a living inhabitant of the earth. But the remains of it are very scanty, and it is doubtful whether they have all belonged to the same kind of bird; there is a foot in the British Museum, the mutilated remains of a head in the Ashmolean Museum of Oxford, and a skull, a sternum, and some bones of the extremities were sent to Paris, which last were discovered in a cave in the small island of Rodriguez, about a thousand miles to the eastward of Madagascar, about fifty years ago. The foot is webbed, and very like the foot of a penguin; and if there ever was such a bird as the dodo, it must have been, like the patagonian penguin, nearly incapable of flight. The account given in the books is, that at the time when the Dutch first visited this Archipelago, that is, Madagascar and the small isles to the eastward, these birds were found in abundance; but the result of all subsequent inquiry has been nothing more than the fragments which we have mentioned. There have been two species of this bird mentioned; but one of them, *Didus solitarius*, and indeed another, *Didus Nazareus*, are certainly spurious, and as no more of the third can be found, it scarcely belongs to popular natural history.



Didus ineptus.

This species (*Didus ineptus*), of which we give a figure, without vouching for its being a likeness of

any bird that ever lived, is described as being one of the largest of the feathered race, but the most uncouth and unwieldy of the whole. Its colour is said to have been black, with only a thin covering of feathers, and the head covered with a membranous hood. Only four or five short black feathers in the place of wings, and a tuft of curly feathers instead of tail. The tarsi short, very thick and stout, and covered with brown scales; the toes very short, webbed, and without any claws. The bill very large, yellow at the base, black at the tip, and blue in the middle portion of its length.

The recent discovery of the apteryx (see the article APTERYX) on the island of New Zealand, and the fact that only the one specimen of that curious bird had been seen by Europeans, gave some ground for believing that there might possibly be in the southern hemisphere, which is remarkable for the singularity of many of its animals, some such bird as this same dodo; but the form given to the bird in the picture, and the weight ascribed to it, namely more than fifty pounds, are rather contradictory of any hope of seeing it. The organisation of the apteryx is no doubt peculiar; as the bird can neither fly nor swim, and from the shortness of its legs cannot be a very swift walker; but the apteryx has still an organisation which one can understand, and perceive that it is not badly adapted for the situations in which it is said to be found, the rocky and stony places on the east side of New Zealand. The dodo, as described, has on the other hand no distinct system of locomotion, and is quite a bird of the *ultima thule*, fit for neither land, sea, nor air. The feet are webbed, but there is nothing to answer to them in swimming; the absence of wings forbids the notion of an air bird, and the feet are not adapted for walking.

DOG—*Canis*. A genus of carnivorous mammalia, and one of the most interesting of the whole class. It consists of several genera, or rather perhaps subgenera; the dog properly so called, the wolf, the fox, the jackall, and the hyæna, all of which produce hybrids, and, generally speaking, we believe fertile hybrids with each other; but though this warrants the consideration and description of all these animals as one group, and though they have many characters in common, yet they are so numerous, and the peculiarities of each are so distinct, that we shall perhaps best observe clearness of description, and propriety of arrangement, if we treat of them under their common names of DOGS, FOXES, HYÆNAS, JACKALLS, and WOLVES. These five divisions fall into two classes, which are founded upon their principal habits. The dogs and wolves have the pupil of the eye round, and they are social in their predatory huntings; and though these huntings are not confined to the day, yet they are, generally speaking, more of diurnal than of nocturnal animals. The foxes and hyænas, on the other hand, are less social in their characters, the foxes especially are of solitary habits, and they are more nocturnal than otherwise, though the time at which they seek their prey is early morning rather than during the darkness of the night. The whole of the group however consists of animals which are peculiarly flexible in their characters; and, the human race excepted, perhaps yield more to climatal and local circumstances than any other family of carnivorous mammalia. They are found in all climates, and they appear to have wonderful facilities of adapting themselves to the climate, being almost destitute of hair in the very warm latitudes, but becoming

clothed with remarkably thick fur when carried to cold climates. This change, not in the same species merely, but in the same individual animal, is so remarkable that some of the dogs which were carried out by our voyagers and travellers to the polar regions of North America, and wintered in the extreme cold there, acquired a fur of so remarkable a thickness that while they crouched by the winter fires their fur was burnt in holes half way down to the skin without their being at all sensible of the heat.

The character of the genns are, that they are digitigrade in their walking, or walk upon their toes, the claws of which are not retractile, or used in any way as prehensile instruments in the capture of their prey, which in these animals is uniformly captured by speed, and following either by sight or on the scent, the strength of the prey determining whether it shall be hunted singly or by a combined pack. The teeth are, six incisors in each jaw, and one strong canine in each side of each, with six teeth above in each jaw, and seven in each below. The first three behind the canines in the upper jaw, and the first four in the lower, have trenchant or cutting edges, adapted for bruising flesh; the great carnivorous teeth which follow these have two points in the upper jaw, with a small tubercle on the inner side. The two last teeth in each side of both jaws are also tuberculated at their summits. In those varieties which are found in a state of nature the muzzle is generally elongated, and the gape wide, the effect of the jaws in killing the prey being that of a snap, in which the rapid motion of the jaw gives effect to the weight; and these species or varieties (for it is exceedingly difficult in this species of animals to say what is a species and what a variety) the ears are generally erect; but in the domesticated ones the varieties are so numerous that it is hardly possible to give any description of them.

No specific form or character of covering can be taken as generally characteristic of dogs; for though their characters are always expressive of the family, as distinguished from every other race of animals, they differ so much from each other, in size, in shape, in the character of their covering, and are so in their propensities, that they have absolutely nothing of external character which will apply to the whole race. The length of their jaws and muzzle, and the shapes of their ears, are exceedingly variable; but the tongue is always smooth, and instead of lacerating, like that of the cat family, its application to wounded or diseased parts has rather a healing tendency; they have five toes on the fore-feet, and generally four on the hind ones, though in some of the varieties there is a partial development of the fifth one. The females go sixty-three days, and the litter consists usually of three, four, or five, though sometimes of as many as ten or a dozen; the puppies are always produced with the eyes closed, and do not open them for ten or twelve days after. They live on the average about fourteen or fifteen years, but there are great differences arising from climate, breed, and other circumstances.

If we take the domesticated races, and it is doubtful whether there are any dogs which have not been partially domesticated, though some have unquestionably degenerated, there are no animals which show so much attachment to man; and the anecdotes which are recorded of the fidelity of dogs would fill many volumes. Perhaps justice is not more effectually done to their characters in a general, and we may say a philosophical view, than in the following passage

which we quote from Mr. Burchell's *Travels in Africa*: "Our pack of dogs," says Mr. Burchell, "consisted of about five and twenty of various sorts and sizes. This variety, though not altogether intentional, as I was obliged to take any that could be procured, was of the greatest service in such an expedition, as I observed that some gave notice of danger in one way, and others in another. Some were more disposed to watch against men, and others against wild beasts; some discovered an enemy by their quickness of hearing, others by that of scent; some for speed in pursuing game; some were useful only for their vigilance and barking; and others for their courage in holding ferocious animals at bay. So large a pack was not indeed maintained without adding greatly to our care and trouble, in supplying them with meat and water, for it was sometimes difficult to procure for them enough of the latter; but their services were invaluable, often contributing to our safety, and always to our ease, by their constant vigilance, as we felt a confidence that no danger could approach us at night without being announced by their barking. No circumstances could render the value and fidelity of these animals so conspicuous and sensible as a journey through regions which, abounding in wild beasts of almost every class, gave continual opportunities of witnessing the strong contrast in their habits, between the ferocious beasts of prey, which fly at the approach of man, and these kind but too often injured companions of the human race. Many times, when we have been travelling over plains where those have fled the moment we appeared in sight, have I turned my eyes towards my dogs to admire their attachment, and have felt a grateful affection toward them for preferring our society to the liberty of other quadrupeds. Often, in the middle of the night, when all my people have been fast asleep around the fire, have I stood to contemplate these faithful animals lying by their side, and have learnt to esteem them for their social esteem to mankind. When wandering over pathless deserts, oppressed with vexation and distress at the conduct of my own men, I have turned to these as my only friends, and felt how much inferior to them was man when actuated only by selfish views.

"The familiarity which subsists between this animal and our own race is so common to almost every country of the globe, that any remark upon it must seem superfluous; but I cannot avoid believing that it is the universality of the fact which prevents the greater part of mankind from reflecting duly on the subject. While almost every other quadruped fears man as its most formidable enemy, here is one which regards him as his companion, and follows him as his friend. We must not mistake the nature of the case: it is not because we train him to our use, and have made choice of him in preference to other animals, but because this particular species feels a natural desire to be useful to man, and from spontaneous impulse attaches itself to him. Were it not so, we should see in various countries an equal familiarity with various other quadrupeds, according to the habits, the taste, or the caprice of different nations. But everywhere it is the dog only takes delight in associating with us, in sharing our abode, and is even jealous that our attention should be bestowed on him alone; it is he who knows us personally, watches for us, and warns us of danger. It is impossible for the naturalist, when taking a survey of the whole animal creation, not to feel a conviction that this friendship between two creatures so different from each other

must be the result of the laws of nature ; nor can the humane and feeling mind avoid the belief that kindness to those animals from which he derives continued and essential assistance is part of his moral duty."

The breeds of the dog, in a state of partial or complete domestication, are so numerous however, and the propensities of different breeds, and of different individuals of the same breed, are so varied, that there is no possibility of giving any thing like a general character of the race, while even a judicious selection of the tales of their biography would fill many volumes. It is impossible not to admire the sagacity and the strength of attachment which many animals of this genus evince ; and as they appear, when properly domesticated, to merge all their own attachments and interests in devotedness to the cause of their masters, it is exceedingly difficult to account for their conduct upon any of the known principles of animal physiology.

That there is nothing at all approaching to what we call reason, or a process of judgment, as men judge of cause and effect, in the sagacity of dogs, is certain, because instances are recorded of the effects of their sagacity, which totally surpass all reason, and absolutely appear as if they were the results of some occult principle, to the nature of which we have no clue. The power of sensation in these animals, especially of the sense of smell in such of them as in a state of nature make use chiefly of that sense, in obtaining their prey, is perfectly wonderful ; and they appear to know not only the spot or scent left by an animal, where there is no impression upon the ground in the least cognisable by human senses ; but they appear to recognise a difference of scent, not only in different animals of the same species, but absolutely in different inanimate substances ; and what is more wonderful, they appear to know the direction in which that which they pursue or follow, has proceeded, even when it has long gone by. We have well authenticated instances of dogs having been carried within carriages, over long distances, where they had no means of examining a bit of the road ; and yet of their returning when liberated, with the most unerring certainty, to the places from which they were originally carried in this artificial manner. A dog too who has had any experience in following on the scent, will not continue for any length of time on the back scent, or direction opposite to that in which the chase is gone, but after a trial or two with his nose, will double round and follow the forward scent or direction which the animal has taken. This is, perhaps, the most extraordinary case of animal sensation with which we are acquainted, and it shows how admirably nature can adapt the qualities of animals to the necessities of their modes of life ; and also how economical nature is in the distribution of even these wonderful endowments. Dogs which find their prey by the sight never have this wonderful acuteness of smell ; and those which have this in perfection have not the powerful sight of those which are without it, neither are they, generally speaking, so swift-footed. But those which have the sense of smell most powerful are, generally speaking, more persevering and staunch than the others, and can follow their game over longer distances, and also find it again much more readily in the case of losing it.

Dogs are, generally speaking, social to some extent or other, even in those conditions which we may consider as more nearly approaching to a state of rude nature ; and, in the formation of their social unions,

for the accomplishment of particular purposes, their instincts are not less wonderful than in the acuteness of their sense of smelling. We shall mention one instance of this, the authenticity of which may, we believe, be relied on ; though it is not easy to account for it upon any known principle either of instinct or of reason, or of that imaginary principle which they who seek to explain that in animals which is not explainable, are in the habit of gratuitously endowing them with. All attempts at explanation of this kind are unwise in principle and ineffective in practice ; and, therefore, attempting them does not admit of any defence on the score of sound judgment. In all parts of nature, in the vegetable and the mineral kingdoms as well as the animal, and even in the simplest substances, or at all events the most apparently simple substances which we meet with in those kingdoms, there are puzzles every bit as inexplicable as the keen senses and wonderful sagacity of the dog ; and we need not vex ourselves at being unable to explain the rationale of these upon any principles analogous to those of which we understand the working, until we have explained why every plant and every animal is, within certain limits, true to its specific type ; and why every crystallisable mineral is faithful to the primary form of its crystal. Throughout the whole of nature, we know very little of the "whys" and "wherefores," and perhaps we should best consult our wisdom and our dignity if we made no attempts to waste our time in speculations in those departments of nature respecting which we must remain for ever ignorant. But to proceed to our anecdote, of which no explanation can, we believe, be given :—

A gentleman residing in the county of Fife, and not very far from the city of St. Andrews, was in possession of a very fine Newfoundland dog, which was remarkable alike for its tractability and its trustworthiness. At two other points, each distant about a mile from each other, and at the same distance from this gentleman's mansion, there were two other dogs, of great power, but of less tractable breeds, than the Newfoundland one. One of these was a large mastiff, kept as a watch-dog by a farmer, and the other a staunch bull-dog that kept guard over the parish mill. As each of these three was lord-ascendant of all animals at his master's residence, they all had a good deal of aristocratic pride and pugnacity, so that two of them seldom met without attempting to settle their respective dignities by a wager of battle.

The Newfoundland dog was of some service in the domestic arrangements, besides his guardianship of the house ; for every forenoon he was sent to the baker's shop in the village, about half a mile distant, with a towel containing money in the corner, and he returned with the value of the money in bread. There were many useless and not over civil curs in the village, as there are in too many villages throughout the country ; but in ordinary the haughty Newfoundland treated this ignoble race in that contemptuous style in which great dogs are wont to treat little ones.—When the dog returned from the baker's shop he used to be regularly served with his dinner, and went peaceably on house duty for the rest of the day.

One day, however, he returned with his coat dirtied and his ears scratched, having been subjected to a combined attack of the curs, while he had charge of his towel and bread, and so could not defend himself. Instead of waiting for his dinner as usual, he laid down his charge somewhat sulkily, and marched off ;

and, upon looking after him, it was observed that he was crossing the intervening hollow in a straight line for the house of the farmer, or rather on an embassy to the farmer's mastiff. The farmer's people noticed this unusual visit, and they were induced to notice it from its being a meeting of peace between those who had habitually been belligerents. After some intercourse of which no interpretation could be given, the two set off together in the direction of the mill; and, having arrived there, they in brief space engaged the miller's bull-dog as an ally.

The straight road to the village where the indignity had been offered to the Newfoundland dog passed immediately in front of that dog's master's house, but there was a more private and more circuitous road by the back of the mill. The three took this road, reached the village, scoured it in great wrath, putting to the tooth every cur they could get sight of; and having taken their revenge, and washed themselves in a ditch, they returned, each dog to the abode of his master; and, when any two of them happened to meet afterwards, they displayed the same pugnacity as they had done previous to this joint expedition.

It should seem that in this case there was a mere momentary concert for the accomplishment of one object among three dogs differing considerably in their habits, and that when this momentary purpose was accomplished, the wonted animosity of the three returned, and they fought as readily with each other as ever. But it does not appear that all casual, or apparently casual interferences of dogs for the benefit of each other, pass off in this momentary way; for there is another well authenticated anecdote of two dogs at Donaghadee, in which the instinctive daring of the one by the other caused a friendship, and as it should seem a kind of lamentation for the dead, after one of them had paid the debt of nature. This happened while the government harbour or pier for the packets at Donaghadee was in the course of building, and it happened in the sight of several witnesses.—The one dog in this case also was a Newfoundland, and the other was a mastiff. They were both powerful dogs; and, though each was good natured when alone, they were very much in the habit of fighting when they met. One day they had a fierce and prolonged battle on the pier, from the point of which they both fell into the sea; and, as the pier was long and steep, they had no means of escape but by swimming a considerable distance. Throwing water upon fighting dogs is an approved means of putting an end to their hostilities: and it is natural to suppose that two combatants of the same species tumbling themselves into the sea would have the same effect. It had, and each began to make for the land as he best could. The Newfoundland being an excellent swimmer very speedily gained the pier, on which he stood shaking himself; but at the same time watching the motions of his former antagonist, which, no swimmer, was struggling exhausted in the water, and just about to sink. In dashed the Newfoundland dog, took the other gently by the collar, kept his head above water, and brought him safely on shore. There was a peculiar kind of recognition between the two animals; they never fought again, they were always together; and when the Newfoundland dog had been accidentally killed by the passage of a stone waggon on the railway over him, the other languished and evidently lamented for a long time.

We must not wonder at this permanent attachment,

apparent gratitude, and apparent memory of grief, because there are very many instances of dogs who have not only refused to quit the bodies of their human masters, but have laid themselves down on their graves, refusing all consolation and all nourishment, and actually continued there till they perished of hunger. Now, if we find instances in which dogs have done this for human masters, or more strictly speaking human companions, we can hardly question its existence as between one dog and another, if the proper circumstances shall call it into exercise. The companionship which the dog feels for man is still part of the character of the animal as a dog; and, therefore, though we do not so well understand the manner in which it is brought about, we have every reason to believe that it must be stronger as between dog and dog, than as between a dog and any other animal. But the communications of animals with each other, and the means which social ones have of forming those connexions with each other which may be called simple attachments, as not being connected either with their feeding or with their physiology, are matters very difficult to be explained.

Perhaps no description of the general character of any animal is more accurate than that of the dog by Buffon; and therefore we shall prefer giving a portion of it in substance to any thing which we could originally write; and we do this the more readily, that popular description is almost all that can be written, except as referring to particular species. The dog, independently of the beauty of his form, his vivacity, force, and swiftness, is possessed of all those internal qualifications that can conciliate the affections of man, and make the tyrant a protector. A natural share of courage, an angry and ferocious disposition, renders the dog in its savage state a formidable enemy to all other animals: but these very readily give way to very different qualities in the domestic dog, whose only ambition seems the desire to please: he is seen to come crouching along, to lay his force, his courage, and all his useful talents at the feet of his master; he waits his orders, to which he pays implicit obedience; he consults his looks, and a single glance is sufficient to put him in motion; he is more faithful even than the most boasted among men; he is constant in his affections, friendly without interest, and grateful for the slightest favours; much more mindful of benefits received, than injuries offered, he is not driven off by unkindness; he still continues humble, submissive, and imploring; his only hope to be serviceable, his only terror to displease; he licks the hand that has been just lifted to strike him, and at last disarms resentment by submissive perseverance.

More docile than man, more obedient than any other animal, he is not only instructed in a short time, but he also conforms to the dispositions and the manners of those who command him. He takes his tone from the house he inhabits; like the rest of the domestics, he is disdainful among the great, and churlish among clowns. Always assiduous in serving his master, and only a friend to his friends, he is indifferent to all the rest, and declares himself openly against such as seem dependent like himself. He knows a beggar by his clothes, by his voice, or his gestures, and forbids his approach. When at night the guard of the house is committed to his care, he seems proud of the charge; he continues a watchful sentinel, he goes his rounds, scents strangers at a dis-

tance, and gives them warning of his being on duty. If they attempt to break in upon his territories, he becomes more fierce, flies at them, threatens, fights, and either conquers alone, or alarms them who have most interest in coming to his assistance; however, when he has conquered, he quietly reposes upon the spoil, and abstains from what he has deterred others from abusing; giving thus at once a lesson of courage, temperance, and fidelity.

From hence we see of what importance this animal is to us in a state of nature. Supposing, for a moment, that the species had not existed, how could man, without the assistance of the dog, have been able to conquer, tame, and reduce to servitude every other animal? How could he discover, trace, and destroy those that were noxious to him? In order to be secure and become master of all animated nature, it was necessary for him to begin by making a friend of part of them; to attach such of them to himself, by kindness and caresses, as seemed fittest for obedience and active pursuit. Thus the first art employed by man was, in conciliating the favour of the dog; and the fruits of this art were, the conquest and peaceable possession of the earth.

The generality of animals have greater agility, greater swiftness, and more formidable arms, from nature, than man; their senses, and particularly that of smelling, are far more perfect: the having gained, therefore, a new assistant, particularly one whose scent is so exquisite as that of the dog, was the gaining a new sense, a new faculty, which before was wanting. The machines and instruments which we have imagined for perfecting the rest of the senses, do not approach to that already prepared by nature, by which we are enabled to find out every animal, though unseen, and thus destroy the noxious, and use the serviceable.

The dog, thus useful in himself, taken into a participation of empire, exerts a degree of superiority over all animals that require human protection. The flock and the herd obey his voice more readily even than that of the shepherd or the herdsman; he conducts them, guards them, keeps them from capriciously seeking danger, and their enemies he considers as his own. Nor is he less useful in the pursuit; when the sound of the horn, or the voice of the huntsman, calls him to the field, he testifies his pleasure by every little art, and pursues with perseverance those animals which, when taken, he must not expect to divide. The desire of hunting is, indeed, natural to him, as well as to his master, since war and the chase are the only employ of savages. All animals that live upon flesh hunt by nature; the lion and the tiger, whose force is so great that they are sure to conquer, hunt alone and without art; the wolf, the fox, and the wild dog, hunt in packs, assist each other, and partake the spoil. But when education has perfected this talent in the domestic dog, when he has been taught by man to repress his ardour, to measure his motions, and not to exhaust his force by too sudden an exertion of it, he then hunts with method, and always with success.

Both the origin and the progressive history of the dog, are matters which defy all investigation; neither can it be said whether all the varieties now existing are or are not from one original stock. Or even whether the wolf be not a closely allied species, and perhaps identically the same. It is useless, however, to enter upon any investigation upon this question;

for the data are too few for warranting a conclusion either one way or another. Dogs appear to be the most obedient of all animals, both to natural circumstances and to artificial treatment; and so there is no knowing how far the differences which are observed among them are owing to the one of those causes or to the other. Of those dogs which are left as it were in a state of nature, or which are not bred or trained in any particular way, there are even greater differences than there are among those which are trained and kept with care. So much is this the case, that those who are in the habit of travelling much in the wilder parts of the country, know the different districts as well from the appearance of the dogs as from any thing else.

Dogs even appear to learn from the general manners of those with whom they associate, as may be observed even in common society. Dogs kept by the vicious, whether they are kept for fighting, poaching, or other ruffian practices, or not, are invariably vicious dogs; and, on the other hand, dogs which live with persons of mild manners and regular habits, when not chained up, which is a species of slavery to which dogs are very adverse, are always mild.

No doubt much depends upon the breed when in a state of domestication; but there is a wonderful disposition to accommodate themselves to circumstances, in the greater number of the race; and when we refer to other countries in which dogs are either in a state of nature, or have been neglected and allowed to run wild, we find that they also partake of the characters of the places where they reside. It is this readiness with which this genus of animals yield to every kind of circumstance, whether that circumstance tend to improvement or deterioration, which renders the progressive history of the dog so utter an impossibility; for though we meet with wild breeds in various parts of the world, which are savage in their dispositions, and exceedingly difficult to be tamed; yet these are just as likely to be the descendants of races which were once tame, as the best bred dogs are to be the descendants of races once wild.

The dog is at all events an old inhabitant of the world; and perhaps there is no animal more generally distributed. Whether dogs existed in a wild state at any period of European history we have not the means of ascertaining; but it is certain that they were in Europe at times long gone by, when the state of the country was very different to what it is at present; for their bones are found in those deposits which contain the remains of the rhinoceros, the tiger, and the hyæna; and though we cannot form very correct notions of how animals not now found in any but warm countries should have once inhabited both continental Europe and the islands, yet we have in India an example of the same races of animals living at least in the near vicinity of each other. But there are many links wanted in the chain before we can in a satisfactory manner connect this oldest epoch of canine story in Europe with the present history of the race.

The uses of this race of animals are so well known, that it is needless to mention them; but still it is doubtful whether they be turned to exactly the most profitable account; and while the savage and his dog are much more nearly upon a par in point of understanding, than any other man and any other animal,

yet it is doubtful whether the dog has had his fair share of the advantages of civilisation, so as to be able adequately to perform his part in the labours of civil society. In the very lowest state of society (we speak of nations, and not of individuals or classes in the same nation,) the dog is, of course, a hunter for his master; and in the forest, and even in the flood, the dog is by far the more independent and the more successful hunter of the two, and could subsist a good deal better without the man than the man could subsist without him.

As society advances a little, the dog becomes an animal of draught; and we find him employed in this state by the people of the extreme north, both in Asia and in America; and as those very northerly tribes are not exactly inhabitants either of the land or of the sea, but rather of the line where these meet, at least during the time that the snow is on the ground, they, of course, can make use only of an animal that can subsist upon such animal food as they can then obtain from below the ice. In some of the southern islands the dog is bred for another purpose. In New Zealand, for instance, there are two species or varieties of dogs,—a large one, which is left free to seek his own food in the woods, as he best may, and a smaller one, which the natives keep in a state of domestication. The large one howls at the approach of the New Zealanders; and all dogs which are not recognised by man as associates in some way or other, growl, or howl and yelp, rather than bark as dogs do in a domestic state. This change of the voice of the dog in consequence of domestication, is an exceedingly curious matter; but it is a fact, and barking is among dogs as much an effect of civilisation, as correct language and eloquent speaking are among men. There is still a closer similarity. The style of the language, not the mere propriety of the words, but the tone in which they are uttered, is no bad index to the general character and disposition of human beings; and so in like manner there is no better indication of the general character of a dog than his voice. The larger dog of New Zealand is not, however, useless to the inhabitants of that country, for it is their principal animal food. Dogs are also eaten by many of the islanders in the Pacific Ocean; and in China they are regularly fatted for the table, and their flesh sold in the butcher's shops. It is also mentioned as an instance of the wholesomeness of dogs' flesh, that the celebrated Captain Cook was mainly recovered from a very severe illness at sea, by the broth and flesh of a dog.

Indeed, there is no reason why these animals should not be cultivated as articles of food in every country. It is a pretty general law in the wholesomeness of animal substances, that if the labour of the animals is not too severe, so that their muscular fibres are thereby rendered too rigid for mastication, their flesh is juicy and racy, and easy of digestion, very much in proportion as they are carnivorous. This holds especially in the case of *gut-birds* and *gizzard-birds* among winged game; and even among the fishes, the few which eat vegetable matter are not nearly so good or so wholesome as those which not only eat animal food, but eat one another. A cod, for instance, is a very king of cannibals, and yet he is a most valuable fish; and the prince of our river fishes, the salmon, is so fond of eating up his smaller associates in the stream, that he may be caught by an imitation of one of them made of a bit of wood and painted. In

spite, therefore, of all our prejudices, and prejudice of some sort or other lies at the bottom of all our self-inflicted miseries and privations—in spite of prejudice, it is really a grave question, and one in which we have the analogy of nature pointing to the affirmative, whether the dog ought not to be regularly bred and fed for the table, as a matter both of good taste and of sound domestic economy. As matters stand at present, it is pretty well understood that all dead dogs are not thrown away, but that not merely the humbler classes, who must be contented with a penny pie or a twopenny sausage, but more dainty palates, are, every day that the sun rises, fain to comfort their stomachs with some such viand as a “savoury *pâte*,” containing a portion of a dog, and it may be with a portion of a cat, which cat may have been doomed to suffer the torture of St. Bartholomew at the hands of some cat stealing and skinning hag.

These matters are at least worthy of some consideration, the more so when we call to mind how comparatively few of the vast numbers of the young of those very fertile animals are brought up alive, and how many of them are cast away almost as soon as they are dropped, and thrown on laystalls and in ditches, and not unfrequently in the streets of the most crowded neighbourhoods, offending the eye, and tainting the atmosphere with corruption and disease. And it must be that the taint of such exhibitions fall more heavily than upon the mere atmosphere, because they display a recklessness for animal life which is more numerous in its instances, more loathsome in its displays, and every way more revolting than even that brutal cudgelling of donkeys which some of our legislators have seen meet to select as the special subject of their wisdom. We do not commend the beating of the animals in question, nor would we be understood as wishing to say anything in disparagement of that wisdom—that strong impulsive gravitation of sagacity by which any one subject is chosen in preference to another as the butt of experimental legislation. But, when we compare the two cases together, it is impossible not to see that there is an occasional attempt made to strain at the gnat and swallow the camel.

The disregard of animal life, more especially canine life, which is produced by this incessant murder of the innocents, is much greater than that resulting from any other cause; and it has this enormity in it, that it goes directly to corrupt the very young, and give them countenance and encouragement in the perpetration of cruelty, and of cruelty to that race of animals which, being more directly the associates of man than any other animals, should not, in a pet individual, or even in any dog considered as property, or of whom any one can say “*my dog*,” and quote the adage, “Love me, love my dog,”—not in any of these lights, but generally as a race, and because of the superior endowments with which, as a race, nature has furnished them, it is our first duty toward animated nature to foster and cherish them; but, instead of this, we are strangely taught that it is matter of course, nay, matter of duty, to take them in their helpless state and drown them in cesspools or kennels, or batter them about in the street with more gratuitous cruelty than we would ever think of battering that which never had any life.

Any ignominy offered to the body of that which once was alive, whether the living thing is an elephant

or a gnat, or any thing within the possible range of the scale of animated being, gives a taint to the mind of deeper enormity, because more direct and more lasting in its consequences than many are aware of. The body of every animal is all that, as a substantive existence, is palpable to our senses; in fact, it is the animal to our understanding; for, though we see the action of life in the living animal, we do not see the life itself; therefore, we never can divest the body of an animal, or even a fragment of one, of that association with life which is grounded upon all that we can possibly observe. Wherefore, every indignity which is wantonly, and in the spirit of triumphing over it, offered to even the mutilated fragment of an animal, tells as a step in cruelty towards the whole of animated nature, and towards man himself among the rest. Even the boy who kicks about the head of a pullet, or the foot of a lamb, which has been thrown into the street as useless, is taking one step in cruelty; and it only requires a sufficient number of steps, however small they are individually, to debase him to the commission of murder or parricide.

As this question, or rather the many important questions which this view of the subject opens up, are new, it may be necessary to caution the reader, who has been accustomed to only the common biographical gossip, or the systematic dreams and conjectures on the natural history of the dog, that this bears more directly on the spirit of the part of that history which will come within the scope of reason and certainty, than anything else which we could say on the general subject; while, in addition to this, it bears very strongly upon one of the most important questions in human conduct, both in an individual and a national point of view; and we have taken it in conjunction with the cruelty practised towards the donkey tribe, in order that the ethical part may thereby be rendered more clear and more striking.

In the first place, this cruelty is done to the animal in a state so young, that it can have done no harm, and might be urged on to do good by kind treatment; whereas, in the harsh treatment of the donkey, there is generally some sort of plea of urging it on to speed, and therefore the cruelty here becomes cruelty only by being excessive; whereas the other is entirely gratuitous cruelty in the very smallest atom of it. In the second place, the cruel treatment of the donkey presupposes that there is a feeling of the present usefulness of the animal; and this, again, requires that the person who perpetrates this kind of cruelty is more advanced in life, and also in vice, than the mere children who perpetrate that other cruelty, which society, with one consent, look upon as a very innocent matter of course. Now, there is always more harm done by corrupting the innocent, than by plunging those who are already initiated a little deeper into vice.

So, also, when we look at the youth, the infancy we may say, of the puppies and kittens which are thus daily destroyed, we find that this tendency to disregard animal life, and therefore to treat animals, including human beings, with cruelty, operates against animals when they are in their most helpless, though, at the same time, their most interesting state. There is no question, therefore, that this wanton destruction, in their helpless days, of those animals which stand to man in a relation of companionship so much closer, and more nearly equal, than is found in any

other case, must have the effect of producing indifference to human children; and this is the gravamen of the evil, both in the conduct of the grown up, toward children, and in the conduct as between child and child. It is in early childhood, far more early than we are in the habit of supposing, that the die of human destiny is cast; and if we habituate the young from their infancy to scenes of cruelty, and cases of uncalled for indignity offered even to the dead bodies of helpless and unoffending animals, we may rest assured that we are shaking with more perilous and certain destruction the two main pillars which uphold the fabric of a sound and wholesome population, than by any single perpetration by the random villains of mature age, which will occasionally spot and deform even the best societies. This must suffice for the moral argument, though it is eminently deserving of far more, and might be made the principal theme of as useful a book as ever was written by man. But we must shortly advert to our proper subject, the physiological view of the case, which is, however, inseparably connected with the moral one.

As we have already seen, in our brief notice of the countries where dogs are found, they are distributed over the whole earth, from the equator to the thick-ribbed ice at the poles, and to the remotest isles of the ocean, often where there are no mammalia except themselves, except it may be some rats, or other murine animals; and, though it is incidental, yet it is proper to add, as a corroboration of what we are about to state, that the incredible numbers, and the wonderfully rapid breeding of those small animals, offers another subject well worthy the attention and the profoundest examination of every one who wishes to look on the works of the Almighty with an eye of usefulness and gratitude. We have seen, also, that the dogs can accommodate themselves more completely to circumstances than any other race, more completely than man himself. In, or nearly approaching to, a state of nature, they may be said to be tempered to every wind of heaven—proof to all temperatures—invincible by fatigue, and patient and enduring under hunger. They are, in short, the mammalia of the greatest labour; and one little dog will perform greater feats in the sum total of activity, during a single day, than the strongest lion in the wilds of Africa could endure in a week. Besides, the foot of the dog is for the earth only, to run, to walk, to leap, or to unearth his prey, or dig, or otherwise trim his habitation. In point of fecundity, dogs are also exceedingly prolific, and they are no more seasonal in their breeding than the human race are. We have said that a litter consists of about a dozen sometimes, and there is no doubt that, with proper treatment, it might amount to this at all times, which might be averaged at something like at least a ten-fold increase in the year, after making ample allowance for contingencies.

That there is purpose everywhere in nature, any one who is not grossly ignorant must admit. But, here is an animal, more completely distributed over all the earth, more completely adapted to all change of circumstances than any other creature upon the earth, endowed with more sagacity than any other creature upon the earth, not excepting even man himself, if he neglects the cultivation and use of his mind, and capable of breeding more rapidly than any other creature of the same size:—here is, in short, the chief jewel in nature's living casket. Can we

suppose that there is no purpose here? Is it consistent with any thing else which we see in nature, that that animal, which is endowed and furnished above all other animals, should be the only one which the Almighty has thus bountifully endowed and furnished, but all in vain?

It is impossible to come to any conclusion so absurd as this, and therefore we must look abroad in nature, and examine what purpose those animals are intended to serve in wild nature, or in countries which have all the richness of virgin soil. Then, if we are able to see our way clearly in this part of the inquiry, we have still another branch remaining, which is highly important, as tending to prove that usefulness to man forms part of the original design which runs through the whole system of nature: and, besides its value in a merely natural history point of view, it is a very strong collateral proof of the truth of the book of Revelation, because it shows that the dominion said to have been given to man is no emanation of human vanity, but a real declaration by Him who cannot lie: "God said, Let us make man in our image, after our likeness: and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. So God created man in his own image, in the image of God created he him; male and female created he them. And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. And God said, Behold, I have given you every herb bearing seed, which is upon the face of all the earth, and every tree in the which is the fruit of a tree yielding seed; to you it shall be for meat. And to every beast of the earth, and to every fowl of the air, and to every thing that creepeth upon the earth, wherein there is life, I have given every green herb for meat: and it was so. And God saw every thing that he had made, and behold, it was very good."

Such is the original declaration; and the benediction of the whole being "very good" involves in it the notion of the general purpose and adaptation running through the whole, fitting all the individual parts for each other, and the aggregate for rational man, as the means of knowledge and the subject of enjoyment.

From what we know of countries in a state of nature, we observe, that in them the working of nature is everywhere in excess; they are clothed with thick forests, the action of which keeps up a continual evaporation and precipitating of moisture by the air; and as the whole of the vegetation which results from this great energy of the powers of nature is adapted for being food to some living creature or other, the quantity of life existing in such countries is beyond what we can well imagine, if we did not actually see it. It is not the mere surface only which is inhabited, for the trees of the forests are tenanted to their very tops, not only with the smaller kinds of living creatures, but with tree birds and tree mammalia, up to the maccaw, which feeds on the topmost fruits, and the sloth, which keeps down the exuberance of the topmost leaves, elinging to the twigs, and back undermost, grazing against the sky, as if it were a sort of ruminating animal turned upside down.

It would be impossible to enumerate all the details

of this exuberance of nature in the early ages of countries, and in all probability before they became the abodes of the human race; but we have, in those memorials which remain buried in the ground, the clearest evidence that such has been the state of many parts of the world in which the natural vegetation has given place to that which man cultivates for his use; and the elephant, the rhinoceros, the large species of stag, and those older animals of more singular forms, and some of them of more ample dimensions, together with those remains of plants which are buried in the soil, clearly show that, even to high latitudes, even the northern hemisphere, this vast exuberance of nature has at one time been general; and, as the remains of man have never been met with in those sepulchres of the times of old, we may reasonably conclude that this state of things was actually anterior to the peopling of the several regions with human beings.

In a state of things where production was so much in excess, it is natural to suppose that destruction must have been equally so, for the two go hand in hand; and the excess of life is really an excess of change, the transference of organic matter from the body of one living creature to that of another. Now, as the earth can be cleared of animal matters only by the labours of animals which prey upon animal substances, and as the habit of the eat family is to lie in wait and prey chiefly upon living animals; and further, as their structure adapts them rather for great momentary efforts than for continued exertion, they are fit only for keeping down the excess of living animals, and that only in particular situations. But, in such a state of things as that which we are considering, the number of dead animal substances with which the earth must have been strewed, and some of which must have been buried under the earth by the deposits left by the waters, there appears a very obvious necessity for a large supply and general distribution of those animals which belong to the dog tribe, and the other divisions of the great genus *Canis*, the fox, the hyæna, the jackall, and the wolf. We accordingly find that these animals have been very numerous in almost every part, at least of the eastern world, though some of them, as the hyæna, have long perished from the northern parts, and others, as the wolf, are fast disappearing.

But, when we take note of the places where these animals are still to be found, we perceive that they are, generally speaking, countries in which there is a strong action in nature, and a proneness to return to the wild state. We are, in the meantime, concerned only with the dog; and the chief places where dogs are found in a wild state are those in which, if culture is even for a short time neglected, in consequence of hostile devastation or of any other cause, the surface is speedily overrun by thick forests or tangled jungles. Those places are India, some of the eastern isles, and many of those in the Pacific.—Every one who has at all attended to the subject must be aware how speedily every neglected spot of India, which is at all within the reach of the periodical rains, is converted into jungle. A single year suffices in many situations to bring a covering of bamboos at least sixty feet high; and as the larger species of eats are adapted for acting on the margin, and in the open glades of the forests, where, though they require cover for their concealment, they also require scope for their spring, it follows that the beating of the forest must

be left to predatory animals of different structure. So also those larger cats cannot prey on wide plains, because they have no concealment in which they can lie in wait; and, therefore, a race of animals to scour the grounds are there required, not only to clear away the decaying substances, but to keep down the numbers of the browsing animals, and of those birds which seek their food upon the ground. In all such situations we have the proper work cut out for the genus *Canis*, though, of course, the tribes of that genus are adapted to different haunts, and possess different habits. What they were originally we do not exactly know; but from their superior sagacity, and the ease and speed with which they adapt themselves to circumstances, it is easy to see that they are exactly the animals to conform their habits to every change of place, and thus to preserve their existence, after those races which, though more powerful in the individual animal, and also in the individual effort, are much less capable of enduring changes.

It is farther worthy of remark, that animals of this tribe have greater adaptation to all varieties of prey, as well as greater aptitude for all varieties of food, than any other of the predatory tribes; their social habits, and the readiness with which they collect at the sound of each other's voices, make them a match in their collective capacity, for any animal which we could suppose to inhabit their common localities. These localities are the intermediate ones, neither the marshy banks of the water nor the bleak hills; and as the more powerful of the pachydermatous animals, such as the elephant and the rhinoceros, are found in the marshes, which are also the resorts of the larger of the genus *Bos*, the dog tribe can always muster in sufficient numbers to master any animal which they have in general to encounter, and as they have more staunchness than any other animals whatever, the killing of a portion of their numbers by the animal attacked, does not turn them from their purpose.

Nor is their habit of miscellaneous feeding of less service to them. This varies in the several tribes, and also in the several varieties of the same tribe, or even with change of circumstances in the same individuals; but, generally speaking, they can eat that prey which they have previously killed, or they can, in case of necessity, eat the most offensive garbage; and also, in case of emergency, subsist in whole or in part upon vegetable substances. They have also some skill in what we may call animal medicine; for when a dog gets diseased either from improper food, or from a surfeit, to which latter he is often subject after long fasting, he knows as exactly the vegetable substance which will set him to rights, as a human *gourmand* of experience knows what to order from his apothecary under similar circumstances.

It is in different parts of India chiefly that the dog is still found in what may be considered a perfectly wild state, or living in the woods toward the mountains, without any apparent disposition to approach the habitations of the human race; and those which have this habit, are still very retired, so much so as to be not very often seen, though they are known to exist, and that in considerable numbers, all the way from Nepâl to the southern heights, and probably to the extremity of India, in all situations where there is sufficient cover for them; but though these dogs are well known, and have been seen and described by Europeans, more especially since Indian zoology has been so laudably and so successfully prosecuted by

British officers, especially those at the out-posts, and detachment stations in the wilder parts of the country, still, with all the knowledge that has been acquired, it is impossible to say whether those dogs existed originally in the mountains and forests of India, or have been allowed to escape in the course of some of those wars by which that country has been so often wasted. We shall have occasion to mention the appearance of this race, when we come to give our list of the leading varieties, so that all we require to do here is to mention that no particular conclusion can be drawn from these regarding what may be the actual habits of dogs in a state of nature. There are other ownerless dogs in the Indian villages, and also in the towns, which resemble more in their manners those varieties which live in the service of man; and these are more social than the dogs of the hill forests. They are advantageous rather than otherwise; because they come and assist the adjutants and other large birds in clearing away the refuse, which otherwise infects the air in an Indian town or village. In this operation they are assisted by the jackalls, which, though they do not make their appearance during the day, begin to yelp in the neighbouring thickets as the dusk sets in; and come during the night to perform their labours, which are far from being without their value.

The circumstances now mentioned with regard to India tend to show the natural uses of the dog in tropical climates; and this is about the utmost extent to which we can go on that part of the subject; because every where else the dog is to some extent or other associated with man, and made to render some sort of service at the bidding of his master. In the more thinly inhabited countries which are wooded, and consequently contain numbers of small quadrupeds, there are many of those half-domesticated dogs which seek their prey by ranging ownerless in the woods; but, generally speaking, they are of the same variety with those that obey human masters. The islands where the larger breed of dogs is kept, or at least captured as game, are almost the only places, with the exception of India, where the wild rangers of the woods and the domesticated ones are of different varieties; and, as the wild dogs there are sought after for food with nearly the same eagerness as game is in this country, they may be considered as in part answering the purposes of flocks and herds to the inhabitants.

In the rest of the world, the other members of the genus *Canis* come in the place of the wild dogs which have been mentioned; and in the extreme north the foxes and wolves, are very abundant; the latter especially are described as being, in the Esquimaux country, the determined and destructive enemies of those domestic dogs which are so eminently serviceable to the people there.

In more advanced states of society, the uses of dogs are so familiar to every one, that it is unnecessary to repeat them; but the probability is that enough is not made of the strength and power of enduring fatigue in those animals. It is true that they are used for drawing trucks and small carriages; and though very many of them are in the hands of persons who do not treat them kindly, yet they have more apparent zeal in the performance of their work, and do more of it in proportion to their size, and the cost of their maintenance than any other of our working animals; and they at the same time act as

guardians of property, when their masters have occasion to leave it with them. Considering these things, it would, perhaps, be desirable to pay a little more attention to the kind of work which dogs could be made to perform, and the best modes of training and applying them to the performance of it. We shall now give very short notices of the leading varieties. This is a part of the subject in which it is not possible to be systematic, for those reasons which have been already explained, and therefore we shall take the grouping of M. F. Cuvier, which is founded chiefly upon the greater or less elongation of the muzzle; but there is little dependance to be placed on the accounts which authors give of the way in which the varieties have been produced, either by change of climate or otherwise.

Dogs, of the first division, have the muzzle considerably elongated, and the capacity of the cranium comparatively small; many of them are very handsome in their forms; but they are not accounted so intelligent as some of the others.

Dogs, of the second division, have their muzzles shorter than those of the first, and the capacity of the cranium much larger in proportion; among them are to be found the species which are most serviceable to man, and we may mention the shepherd's dog as an instance.

Those of the third division have the muzzle still shorter; and they are, generally speaking, stouter made than any of the others, and some of them are more ferocious.

The character on which these divisions are founded is a very imperfect one: and the varieties in each, in some instances, differ more from each, both in appearance and in character, than those of the different divisions. It may generally be said that the long-nosed varieties bite by snapping, and give a very powerful bite from the length and quick motion of the jaw; but they do not keep their hold; that those of the third division bite by seizing and retaining their hold, and performing a good deal of their operations by shaking their prey, while they retain a firm hold with the teeth; and those of the second division incline more to the one mode of biting or the other, according to circumstances.

1. LONG-MUZZLED DOGS. The species which are most nearly in a state of nature belong to this division, and we shall take them first in order.

THE WILD DOG OF NEPAL (*Canis primævus*). This variety, which was first accurately described by Mr. Hodgson, extends over a very large portion of India; and as the country is inhabited by many races, it is known by different names in different districts. In Nepâl and the adjoining countries where it is found upon all the lower ridges of the Himalaya, from the Sutledge to the Burhampootra, it is called *Bûánsû*; in Bengal it is *Dhole*; and with the Mahrattas of the Deccan, it is *Kolsur*. Over so wide a range as fifteen hundred miles in latitude, and more than a thousand in longitude in some places, it must have considerable climatal differences; and there seems also to be some slight difference in its appearance upon the elevated grounds, and in the valley of the Ganges; but all its more essential characters are the same wherever it has been observed; and one of these characters is peculiar, the want of the second tuberculated tooth in the lower jaw. Mr. Hodgson is of opinion that this is the parent stock of all the domesticated dogs; and it is for this reason that he has

given it the name of *primævus*; but the hypothesis is a mere assumption, which does not admit of proof, and therefore the name is somewhat objectionable. The chief climatal difference is that in the elevated and comparatively cold country of Nepâl, it has much thicker and stronger fur, and is darker in the colour than in the more southerly parts of India.

This dog certainly belongs to the long-nosed division; for the character of that division consists more in the compressed form and small capacity of the skull, than in the mere elongation of the muzzle. Its nose is not very sharp; its eyes are obliquely set with round pupils, and brown irides. The ears are long, erect, and a little rounded at the tips. The body is rather slender, but deep in the chest; and the legs are long, very strong, and rather thick; the tail is tapering, and borne with no recurvature. The neck is long. The whole character has, indeed, a considerable resemblance to that of a Persian greyhound, in a rude and savage state, and exposed to the vicissitudes of a very variable climate. The colour is, generally speaking, a sort of reddish brown, a little darker toward the tip of the tail, and also between the eyes and nose.

These dogs prey equally during the night and during the day, but their chief dependence seems to be upon the scent: they hunt in small packs of eight or ten; and when in pack they are described as giving tongue in a sharp savage bark, unlike that of any domesticated dog, or of the fox, or the jackall; but when they pursue their prey singly, they only utter an occasional growl. They are animals of great vigour and perseverance, and seldom fail in running down antelopes, deer, and other swift-footed game. As we have already mentioned, this species is wild as well as fleet, and therefore it is seldom seen. When a pack are met with, they do not attack human beings, and thus they are quite harmless to the inhabitants; but when they are assailed, they defend themselves, and turn on their assailants with great courage and vigour. When old ones are taken they do not appear to be susceptible of acquaintance with mankind; but when the young are reared in a kennel with other dogs, they recognise their masters and associates, and evince nearly the average intelligence of the usual sporting breeds which are used for running down game.

The *Pariah dogs* which we have mentioned as abounding in and about the villages, have sometimes been referred to this division; but they have many more of the characters of the more capacious-headed dogs of the second division; so that, though in some respects they stand intermediate between the present variety and the various bred dogs of India, it does not appear that these can be considered as bearing any general relationship to them, though it is not unlikely that there may be crosses and mongrel breeds. The *Pariah dogs* themselves are, indeed, a mongrel race; and it cannot well be otherwise; for they mix freely, and without quarrelling with the domestic dogs.

All the native dogs of India, we may remark, appear to be different from any of the European breeds; though among them there are hairless races something like those which are found in Egypt and the parts adjacent.

THE MALAY DOG seems to be nothing else but the wild dog of India, farther changed by still greater difference of climate; and as it is pretty generally

understood that the eastern islands even as far as the Archipelagos of the central Pacific, it is highly probable that the dogs there are still originally of the same variety.

THE AUSTRALIAN DOG OR DINGO. This seems still, in its essential characters, to be the same dog; and as there is no placental animal of nearly the same dimensions in Australia, and the Malays have long frequented the northern parts of that country, it has in all probability been imported by them; though



The Australian Dog.

as the natives of Australia had no memory or tradition beyond their personal observation when they were first visited by Europeans, it is not at all likely that they could have remembered the importation, more especially as their topographical knowledge appears just as limited as their natural history. The following is the description of the Australian dog: the head is much elongated and compressed, and tapers abruptly towards the muzzle, having much the appearance of a fox, with short erect ears. In the general proportion of the body he resembles the shepherd's dog. His body is thick with hair; his tail bushy; the hair is of two sorts, one woolly and grey, the other silky and of a deep yellow. The colour is deepest on the top of the head, and on the upper parts of the neck and tail, and the back; the under parts of the neck and tail are paler; the muzzle and face and inner side of the hams are whitish. The tail has eighteen vertebræ (dogs in general have nineteen). The length of the body from the point of the nose to the commencement of the tail is two feet five inches. This dog possesses great agility, and is full of courage; when running he carries his head up and his tail raised or extended horizontally; and he is very voracious, seizing upon every kind of animal food that comes in his way. According to the description, the dingo is altogether rather smaller in size, shorter in the legs and neck, and by no means so fleet as the wild dog of India; but still the differences in these respects are not sufficient to refute the notion of both being originally the same race; and we may see why they should be different, both in appearance and character, when we reflect on the difference between the countries which they inhabit. From the great numbers of deer, antelopes, jungle fowl, and game of all sorts, India is a remarkably good dogs' country; and we have experimental proof in the fact of there being two irreclaimed races in supplement to all the tame ones. Australia, on the other

hand, is just as bad a dogs' country as we could well suppose. Most of the small animals are climbers and even a sort of fliers, or leapers a great way from branch to branch by the help of the extended membranes attached to their legs; they also live in hollow trees, and places where dogs cannot easily get at them; and thus the only game which is left for the dogs is the kangaroo, which is a fleet jumping animal, far from numerous, and capable of breaking the skull of a dog by the stroke of its immense claw, when it kicks out in running. These may be among the reasons why the dingoes were originally found almost wholly in attendance on the bivouacs of the natives; and it also explains why this animal, which is said to have been a favourite with the poor natives, has become a notorious sheep biter, and even an enemy to domestic dogs, since sheep and other European animals were introduced into the colony. On the first introduction of sheep into the highlands of Scotland, about the time when the old practice of honourable cow-stealing by the men began to fall off, the curs of many places became notorious sheep-stealers; and there are perhaps no dogs which will not kill sheep when pressed for food, if they have not been taught the contrary.

THE AFRICAN DOG. The native dogs, which are in a state of semi-domestication among the rude nations of Africa, appear to be of nearly the same race as those which have been already noticed, only by being more domesticated their colours are more variable. Their habits are not much better known than the general characters of the countries in which they reside. The following are some of the particulars which are detailed. The wild dogs of Lower Guinea go out to hunt in large packs, and when they meet with a lion, tiger, or elephant, in their course, they set upon him with great fury, and usually overcome him. In these encounters they often lose a number of their pack. They do little or no damage to the inhabitants. They are red-haired, have small slender bodies, and their tails turn up upon their backs. The wild dogs at the Cape of Good Hope also range in large packs, and clear the whole country where they abound of all the wild beasts, and even the domestic flocks belonging to the several districts. What they kill they carry to a place of rendezvous, but allow the Europeans and Hottentots, who follow them, to take what they think proper without resistance. The Hottentots eat the flesh they thus obtain, and the whites salt it for their slaves.

SOUTH AMERICAN DOG. When America was first visited by Europeans, the Indians, both of the south and the north, were in possession of dogs in a half tamed state, and agreeing in many of their characters with those dogs of the eastern continent which have been described. Since then the numbers both of Indians and of dogs have been very much thinned in all the better known parts of the country; but they are still to be met with, and in the wilder places where the Indians have retained their old habits, they are still in possession of the dogs.

The South American dog resembles the wild dogs of India rather more than those of the Asiatic isles, of Australia, or of Africa. The muzzle is rather slender, the ears short and erect, and the hair pretty long, especially that on the tail. The prevailing colour is grey with a tinge of brown on the back, a yellowish tinge on the under part, and ochre-yellow spots on the flanks. In the South American forests, where

peccaries and other small mammalia are plentiful, these dogs abound in the wild state, lodging during the day in burrows, which they dig in the ground, and seeking their food in the night. The old ones are not susceptible of attachment, but those which are taken young can be so far tamed that they are not disposed to join their fellows in the woods; but they are not very sagacious or very tractable. The temptations are so great, owing to the abundance of food, and the close and cool cover during the burning heat of the day, in the thick forests of America, that it is difficult to keep any predatory animal out of these forests; and in Surinam and the adjacent settlements, where, in consequence of the number of rats that infest the sugar manufactories, cats are in much request as domestic servants, the people are obliged to cut their ears close by the head in order to keep them at home. This has the desired effect both in the dry weather and in the rain, as the leaves and branches tickle the inside of the ear in the one case, and the rain gets into it in the other, both of which is very much disliked.

NORTH AMERICAN DOG. This variety differs a little from the former; its expression is milder, and he is understood to have a keener scent, and to be more active in the chase, not being so much a dog of the woods as the South American, and being under the necessity of chasing swifter-footed game.

From these varieties we can form some idea of a dog in something like a state of nature; and it is worthy of remark, that though these dogs inhabit regions which are almost the opposites of each other in longitude, and are found both to the north and to the south of the equator, yet there is a very great family likeness among them; so much, indeed, that we can hardly regard them as any thing else than climatal varieties. They are probably the most tropical of all the dogs in their present distribution; though it is inferred from the shape of the bones in the fossil specimens which have been met with in Europe, that this description of dog, or a variety nearly approaching to it, was the one which lived coeval with the more powerful carnivorous animals, and the larger pachydermatous animals in that part of the world. This is rather a curious fact in natural history, and would lead us to infer that certain species or varieties of animals have, in the course of ages, belonged as much to eras in the history of the world as to geographical positions.

Those which we have enumerated, with shades of difference in other localities, which would have been much too minute for popular purposes, are all the dogs which we consider as remaining in any thing like an original state, that is, a state in which their manners and their forms have not been to a great extent modified by the treatment which they have received from their human masters. Or, if they are dogs which have been left to themselves, then they have been so left long enough for acquiring a far more uniform and unchangeable character in their localities than those dogs which are in a state of complete domestication. We shall now give a short enumeration of the leading domesticated ones which belong to the first division, or those with the elongated muzzle, and diminished capacity of skull, acuteness of scent, and tractability and sagacity.

There are two sub-divisions of these domestic varieties, one of which, the greyhound of the Highlands of Scotland, or, perhaps, the Albanian dog,

is the type; and another, of which the common greyhound is typical. The chief distinctions of character between these are, that the first hunt their prey either singly or in packs, and can find it by the scent as well as the eye, though not very readily; and the second hunt singly, and find their prey almost exclusively by the eye.

THE HIGHLAND GREYHOUND. This is a very powerful dog, equally staunch and faithful; and, when the Scottish mountains swarmed with stags and roes, it was held in high estimation, as being capable of following the deer over surfaces too rough and fatiguing for the ordinary hounds of the low country. The



The Highland Greyhound.

general aspect of the Highland hound is commanding and fierce. His head is long, and muzzle rather sharp; his ears pendulous, but not long; his eyes large, keen, and penetrating, half concealed among the long, stiff, and bristly hair, with which his face is covered; his body is very strong and muscular, deep chested, tapering towards the loins, and his back slightly arched; his hind quarters are furnished with large prominent muscles, and his legs are long, strong-boned, and straight—a combination of qualities which gives him that speed and long duration in the chase for which he is so eminently distinguished. His hair is wiry and shaggy, of a reddish sand colour, mixed with white; his tail is rough, which he carries somewhat in the manner of a staghound, but not quite so erect. This is the dog formerly used by the Highland chieftains of Scotland in their grand hunting parties; and is, in all probability, the same noble dog used in the time of Ossian. The Scottish highland greyhound will either hunt in packs or singly. A remarkably fine and large dog of this description was a long time in the possession of Sir Walter Scott, bart., and was a most appropriate guardian for his unique and magnificent seat at Abbotsford. This splendid dog was presented to Sir Walter Scott, as a mark of the highest respect and esteem by the late chieftain, Macdonell of Glengarry. He preserved this race of dogs with much care; and, in order to prevent the degeneracy which arises from consanguinity, he was in the habit of crossing the breed with the bloodhound from Cuba.

and also with the shepherd's dog of the Pyrenees, which is distinguished for its size, beauty, and docility, Sir Walter Scott's Maida was the offspring of a sire of the latter species, and a dam of the Scottish highland race, and certainly was one of the finest dogs ever seen in that country of the kind, not only on account of his symmetry of form and dignified aspect, but also from his extraordinary size and strength.

This fine specimen of the dog probably brought on himself premature old age, by the excessive fatigue and exercise to which his natural ardour inclined him; for he had the greatest pleasure in accompanying the common greyhounds; and, although from his great size and strength, he was not at all adapted for coursing, yet he not unfrequently turned, and even ran down hares. Maida lies buried at the gate of Abbotsford, which he long protected; a grave stone is placed over him, with the figure of a dog cut on it by Mr. John Smith of Melrose, and bears the following inscription:—

Maida, tu marmorea dormis sub imagine Maidæ
Ad januam domini. Sit tibi terra levis!

This powerful and splendid variety of dog was, in the olden time, employed in hunting the wolf, as well as the deer; but the circumstances of the Scotch highlands have changed, the wolf is no more, and the deer is so rare in most places that it ceases to be an object of sport, except to the few who have it as property. The stocking of the hills with sheep has also dislodged the deer, and rendered the deer dog a forbidden visiter. Gentler sport has succeeded, and the soft sportsman of the south, with his pointer and his Joe Manton, have come instead of the driving dog and the daring highlander.

THE IRISH WOLF-HOUND. This race has also become *nearly* extinct, though there are still a few. It was, probably, larger than the highland greyhound, yet it still bore a considerable resemblance. The occupation of this variety is also gone; for there are no deer in *feræ naturæ* in Ireland, and through some mismanagement, dreary and wasteful bogs have come in the stead of her forests, and the memorials of her deer must be sought under these wasteful and neglected accumulations. The following is probably the last general description, from nature, of the hound.

In 1790, Mr. Lambert saw eight of them in the possession of Lord Altamont. They were the sole remnant of their race, which had then degenerated: the hair was short and smooth, brown and white, or black and white. One of the largest dogs was sixty-one inches long from the muzzle to the point of the tail, which latter was, of itself, seventeen inches and a half in length. The ears were six inches long and pendulous. The height from the toe to the top of the fore shoulders, twenty-eight inches and a half; the circumference of the breast thirty-five inches, and of the belly, twenty-six. All were good tempered; and in former generations the race are said to have borne a great resemblance to the greyhound. If this latter fact is well authenticated, it throws some light upon the progressive history of this first division; for the dogs of this subdivision stand something intermediate between the greyhounds, properly so called, and the wild dogs; and so, if there is a return from the greyhound to the type of this subdivision, there might be a return in this to the type of the wild dog.

There are dogs evidently resembling these in other countries, such as the large and rough greyhound of Russia, and that of the low lands of Scotland; but

a particular account of them would not add much to the natural history of the genus.

ALBANIAN DOG. If the wolf dogs of Ireland and the Scotch Highlands were celebrated in the middle ages, the Albanian dog was not less so in the classic times of old. They are the veritable hounds of the Goddess Diana; and whatever it may make with reference to the goddess, it is good evidence of the excellence of the dog, that one presented by the immortal huntress to Procris, her favourite, was so staunch, that it never missed its prey. These appear to have been dogs in high estimation, through all the mountainous parts of Greece, and the breed is still preserved, especially in the wild country after which the animal is named. This dog is about the size of a mastiff, his hair is of a very fine consistence, very thickly set, resembling fur, and of a long and silky texture, generally of different shades of brown; his tail is long and bushy, which he carries somewhat in the manner of a Newfoundland dog; his legs are strong, shorter, and with more bone than those of the greyhound, on which account he seems formed for strength rather than for excessive speed. The head and jaws are elongated, with the nose pointed, something like that of the Greenland dog, but rather longer. This dog in former times was used in hunting the wild boar and the wolf, as well as in fighting; and was also reared in pastoral districts to protect their folds from wolves and thieves. We may naturally expect that there should be some climatal varieties in other parts of Europe of a dog which has been so long known to history. One of these probably is

THE SPOTTED DOG, DALMATIAN, OR HUNGARIAN DOG. This is more an ornamental than a useful dog; as it is soft in its manners and far from being intelligent; but it is very handsome and very good-natured, and therefore it is much used as an attendant on carriages. It is so well known as to require no further description. In form, this dog bears a slight resemblance to some of the hounds, or the smooth pointers, but he has none of their valuable qualities.

THE FRENCH MATIN. This dog is very different from the last mentioned, and possesses properties in some respects superior to any other dog of the division, on which account he is a great favourite in France, where his fidelity and his courage equally recommend him. His general characters are,—the head elongated, and the forehead flat; the ears pendulous toward the tips, and similar to those of the greyhound; the hair is generally of a yellowish fawn colour, with blackish, slate-coloured, oblique, and parallel indistinct rays all over the body. He is a very active and muscular dog, standing about two feet high, and three feet long. He is possessed of great courage, and displays much ferocity in attacking wild boars and wolves, in the hunting of which he is frequently used, and evinces great perseverance and eagerness in the chasing of them. The principal use of the matin in France is the tending of flocks, in which service he has all the qualities of the shepherd's dog of this country; he is likewise employed as a house-dog, and is extremely assiduous and watchful in that capacity, protecting his master's property to the last extremity. In France he is held in higher estimation than any other of the watching or guarding dogs. But we must turn to the varieties which are still more deficient in scent and sagacity, but have that deficiency compensated by additional swiftness, great quickness of ear, and considerable acuteness of

vision. The general name of these is *greyhounds*, though that name is also given to the large and powerful wolf-dogs of the former subdivision, which have both the body and the muzzle much elongated, and are remarkable for their speed when on the chase. There is this difference between them, however, that the dogs formerly mentioned, are much stronger, do not, in general, run so swiftly, but can continue much longer.

THE GREYHOUND. The greyhound is the very model of animals for symmetry; and while his limbs are peculiarly muscular, though lightly made, there is no dog, and perhaps no animal, which has such elasticity of the spine. In many of the cat tribe that organ can be powerfully exerted for a short time; and in some of the *viverridæ* it acts powerfully for a continuation of leaps; but in no animal do the spine and the limbs play so beautifully to each other as in the greyhound. The general character of the animal agrees with this elasticity of motion; for there are few which are so actuated by fits and starts. The figure of the greyhound is so peculiar, so little likely to be confounded with that of any other dog, that it is quite unnecessary to go into any description of it. In ancient times the greyhound was reckoned a very valuable present, by the ladies especially, who regarded it as a very gratifying compliment. As far back as the time of King Canute, it was enacted by the forest laws, that no person should presume to keep a greyhound under the degree of a gentleman; the sovereign regarding that animal as being peculiarly suited only to a person of elevated rank. In Charles the First's reign, greyhounds were held in very high estimation. The Isle of Dogs, which is now converted into the reservoir for the West India shipping, derives its name from being the receptacle of spaniels and greyhounds of Edward the Third; and was selected from its contiguity to Waltham and the other royal forests.

Much of the superiority of our present breed of greyhounds we owe to the judgment and perseverance of Earl Rivers and others.

The Scotch Greyhound, which is in all probability the *gazehound* of England, is larger than the smooth greyhound of England and the warmer parts of Europe, and it is also of larger size, though not so elegant, and probably, for a short distance, not so fleet. It is generally understood that this was the dog employed in driving the deer in the moors of the south of Scotland, and the north of England, at the time when that was so principal an occupation of the barons; but in the pure state this hound is now comparatively scarce.

The Turkish Greyhound is comparatively a small species with very little hair, so little that it does not hide the black skin. Its ears are not quite so pendent at the tips as those of the greyhound, properly so called; and it is so insignificant in size, that it is only used as a pet. There is, however, a greyhound of the chase very much used in some places of the south-east of Europe; and there is another in Persia, which resembles the wild dogs more than the wild dogs of Europe. The little *Italian greyhound*, which is very handsome, is used as a pet in many parts of Europe; and it is a very lively little creature, but not remarkable either for attachment or sagacity. Such is a short outline of the leading varieties of dogs in the first or long-nosed division.

II. DOGS WITH THE MUZZLE OF MEDIUM LENGTH. This section also admits of several subdivisions,

according to the uses to which they are applied, and the properties which fit them for those uses. The principal subdivisions are hunting dogs, and dogs which, though they have a propensity for hunting, are more used for domestic purposes, or in some way to assist man in his labours.

Of the hunting dogs there are two or three farther subdivisions, the chief of which are dogs which are used in the chase, and dogs which are used with the gun; the last of which are most generally employed, except by those who sport on a large scale. The first are hounds of various descriptions; the others are setters, spaniels, and a variety of others. We shall begin with

THE BLOODHOUND. This hound is, or rather was—for in most European countries, at least, the breed is nearly extinct—the best on the scent of all the coursing dogs, and perhaps, also, the most staunch and persevering in pursuit of his game. When his human associates happened to be of mild dispositions and contented themselves with using him only in the legitimate way in which a sporting dog should be used, he was mild tempered and exceedingly tractable; but the very virtues of this dog were perverted through the vices of his masters; and down to a comparatively recent period, and perhaps in some places even at the present time, the bloodhound has been trained to hunt human beings, and so add to the horrors of war, and the relentless cruelties of extermination. This dog has been used for these purposes in different parts of the world; so that of the few which remain, there are several apparent varieties.

At one period of the world's history, the commencement of which was in ancient times, bloodhounds were much used in Britain, and the breed is said to have been very superior. According to Strabo, British bloodhounds were used as auxiliaries in the wars of Gaul; and there is no doubt that this prostitution of a noble animal to the basest of purposes, is the reason why, from time immemorial, this dog has had a bad name, and that "bloodhound" has been the appellation for such monsters of the human race, as could not be done justice to by any epithet drawn from the very worst vices of mankind.



The Bloodhound.

The following particulars will throw some light upon the character of an animal now little known, and also the uses to which this animal was applied:—In

old times, when possessions were insecure, the bloodhound was employed to trace out the thief, and recover the stolen goods; so that he would swim a river in course of the pursuit, and immediately recover the footsteps of the culprit on the other side, never ceasing to follow him until he was taken. Thus this animal is put under the protection of the most ancient laws, which enact, "that no person should stop or disturb a bloodhound or man passing with him, to follow thieves, or take malefactors." Theft was also so common in this island, that a person denying access to the hound was held participant in the crime. There is little doubt that it was known on the continent, and also in England; but the Scottish bloodhound, which is said to have been of large size and elegant proportions, was the most celebrated of all. Conrad Gesner, who wrote nearly three hundred years ago, has preserved a figure of the Scottish bloodhound, which, he says, was transmitted to him by Henry Sinclair, Dean of Glasgow, a distinguished character of his era; and Hector Boyce affirms, that it was of a red colour, or black with small spots. There was some difference between it and the English bloodhound, though the properties of the latter were also eminent.

Of the atrocities which were committed in ancient times by using bloodhounds against the human race, no accounts have come down to us; but unfortunately we have specimen enough of what can be perpetrated in this way, in perhaps the blackest page in a volume of human history, no part of which is very bright. This is the history of the conduct of the christian white men of Europe toward the unoffending red men of some parts of America, and, more so, to few of the hapless sons of Africa who had been captured and carried away to endure all the miseries of colonial slavery. Even the great Columbus himself, in order more completely to subdue the lawful owners of the island of Hayti or St. Domingo, carried out with him twenty-four bloodhounds as auxiliaries in his unjustifiable war upon the harmless and newly discovered natives. It is possible that all the occasions upon which bloodhounds have been used against negro slaves which have taken refuge in the mountains have not been recorded; but a single specimen of their use by the French, some time previous to the island being wrested from their power, will suffice. In the last war carried on against the revolted negroes, or Maroons as they were called, they employed bloodhounds regularly trained against them, and they are even said to have had the barbarity of throwing their captives to the dogs to be devoured alive. In training the hounds to this inhuman pursuit, we are told that they were confined in a kennel sparred like a cage, and sparingly supplied with the blood of other animals. The figure of a negro in wicker work, stuffed with blood and entrails, was next provided as they grew a little older, and occasionally exhibited in the upper part of the cage: the dogs ferociously struggled against their confinement, and as their impatience increased, the effigy was brought nearer and nearer, while their usual subsistence underwent still greater diminution. At length it was resigned to them, and while voraciously tearing it up, and devouring the contents, the caresses of the keepers encouraged their perseverance. Thus their animosity to black men was excited in proportion to their attachment to the whites; and they were sent out to the chase when their training was considered complete. The miser-

able negro had no means of escape: he was either hunted down and torn to pieces, his wife and children sharing perhaps his calamity, or, if taking refuge on a tree, he was betrayed by the yelping of the bloodhounds into the power of his more savage pursuers. This, however, was not the full extent of the evil. "But, indifferently kept in the neighbourhood of Cape François, the dogs frequently broke loose, and infants were devoured in an instant from the public way. At other times they proceeded to the neighbouring woods, and surprising a harmless family of labourers at their simple meal, tore the babe from the breast of its mother, or devoured the whole party, and returned with their horrid jaws drenched in the gore of those who were acknowledged, even in the eyes of the French army, as innocent, and therefore permitted to furnish them with the produce of their labours."

The stages of cruelty are progressive; and those who delight in the torture of animals, will soon be indifferent to the sufferings of mankind. Accordingly, the ruder nations universally enjoy ferocious contests, and are gratified with the sight of blood. Lions, tigers, and elephants, have been encouraged to tear each other in pieces, where mutual antipathies ceased to operate; but to make use of that quality in the dog, which fits him especially for being the servant of man—to make use of that quality as an instrument of the most inhuman torture upon those who were already suffering misery enough, is beyond a parallel in the annals of atrocity.

In hunting, which was his legitimate work in those days, when much of the country was in the condition of forest and chase, deer numerous, oxen few, and sheep not introduced in many places, the proper function of the bloodhound was to find the game rather than to run it down; and it was because he could find the scent or *slot*, as well as keep it till he came on the game, that he was called the *slot-hound* or *sleuth-hound*. He was also called the *slow-hound*, in which the epithet *slow* may have in part been a corruption of *sleuth*, though it also related to the rate of his following as compared to that of the deerhounds, which, as keeping more on the view than on the slot, run with much more velocity. The stannish perseverance and continued following of the bloodhound compensated for his inferior swiftness, as without him the deer could not, in many cases, have been found; and if the deer threw the staghounds out, the bloodhound was ready to find him again. The perfection to which he could be trained for the slot was very wonderful, and forms a very curious portion of the doctrine of the sense of smell. To prepare him for his labour, his nose was either rubbed against the kind of animal in quest of which he was to go, or with the hand of a man which had been so rubbed. This being done, the hound was let slip; when he instantly began beating for a slot; and, though the scents of ever so many animals lay on his beat, he never followed except on the right one. It was in this that the great superiority of the bloodhound consisted. Many other dogs of the chase can be trained to *one* kind of game; but there were none who could be trained to *any* kind in a summary manner like the bloodhound.

It would be very desirable to know upon what this capacity of being able to distinguish species in scents depends; but the question is, we fear, beyond the possibility of solution.

THE STAG-HOUND is now the largest variety of

hound in Britain, and the numbers are very few; and for *bona fide* stag hunting we may say there are none, though there is an occasional run "for sport" at a carted stag. Numerous packs are used upon these occasions, which are got up more to show off the pack than for any other purpose. The stag-hound is a large, handsome, and tractable animal, but much inferior, in point of nose, to the bloodhound.

THE TALBOT. This name is usually associated with that of the "Old English" hound; but, as is the case with the "gazehound," it is not satisfactorily known what particular animal is meant. "Talbot" is certainly an old English name, in the same way as *Matin* is a French name. We suspect, however, that calling the talbot the old English hound is just about as correct as it is in the manufacturers of dictionaries to call the *matin* the mastiff. The probability is, that talbot was a general name for hounds, whether they were used in the chase or as watch-dogs, when those hounds were not trained to some one particular sport.

THE FOX-HOUND. This species may be said to be, at the present time, the favourite hound in Britain, and great attention has been paid to the breeds; so that, whether in private kennels, or in subscription or country packs, there is perhaps no country in which this variety of dog has been brought to so much perfection as in England. These dogs have a keen scent, and the style of their running is very fine, and especially the air with which they carry their heads. Where the ground will admit of it, fox-hounds run more in rank than any other dogs, and sometimes the column presents a pretty long front in line. The nose of the fox-hound is rather long, and, in proportion to his body, his head is small; his ears are pendulous and long, but not so much so as those of either the stag-hound or blood-hound. His chest is deep, his legs are very straight, his feet round and well proportioned, his breast wide, his back broad, his shoulders are placed well back, his neck thin, his tail bushy and thick, which he carries high when in the chase. His colour is generally white, variously patched with black brown and liver colour in different parts of the body. Fox-hounds, and indeed all hounds which are kept for hunting in packs, can be regarded as in only a state of partial domestication. They are, as it were, the military of the race, take the field in squadrons, live apart in their kennels or barracks, and do no civil duties.

THE HARRIER. This species resembles the fox-hound, only it is smaller, less powerful, and, generally speaking, not so ferocious. Harriers are more generally kept in Britain than fox-hounds, there being much more scope for hare hunting than for fox hunting; for, as the country becomes more cultivated, foxes diminish in number, while, under the same circumstances, hares increase. Harriers do not run so majestically as fox-hounds, but their cry is much more musical and agreeable.

THE BEAGLE. This is smaller than any of the other varieties of hound, and by no means so fleet in the chase. It, however, possesses qualities which are in some respects superior, being more sagacious, and possessing a much better nose, so that it can follow on the scent in situations where the harrier would be thrown out.

Besides those which have been noticed, there are several other denominations of hounds; but the above must suffice as a general sketch of the race.

Somewhat allied to hounds are the *Terriers*, a

smaller breed, but much more strongly made, more courageous, better mouthed, and, along with great sharpness of bite, possessing no inconsiderable share of the bull-dog property of retaining their hold. We believe they are not used in packs, or much in the chase in any way, their chief use being to bring burrowing animals out of their earths; and so staunch are they at this, that a terrier will often draw a badger of more than his own weight. Terriers attack all wild animals indiscriminately, and they are not to be turned from their purpose either by largeness of size or by rankness of smell. They are, properly speaking, the *vermin* dogs; and though they are very expert at unearthing, and very forward in attacking foxes, hares, and rabbits, they are equally efficient against badgers, polecats, weazels, rats, and mice. On account of their latter propensity, they are very much used about farms, and about houses generally; and, though they are somewhat irritable, they make most efficient watch-dogs, as they are not only very forward to attack, but very formidable, and exceedingly difficult to be vanquished. There is no doubt that a sufficient number of them would be able to overcome the largest wild animal; and they have a sort of natural propensity to the hog tribe, and might, even in smaller number than some dogs of larger size, be efficient against the wild boar. The writer of this article knew a gentleman who had a very fine Scotch terrier, which not only cleared a large farm, and also the farm-yard, of all vermin, but acted as cattle-dog or sheep-dog, as occasion required, and was so vigilant and so formidable a guardian, that no intruder could with impunity either invade the house or trespass on the farm, but used successfully to repel the inroads of a very powerful and fierce boar which used to come in a furious and formidable manner, so much so, indeed, that he often threw the labourers in the fields into the greatest alarm; but if *Trap* happened to get notice of the invasion, the boar, though very large, much in the shape of a wild boar, and of that brindled colour which indicates the nearest approach to that formidable animal, paid severely for his temerity; the dog, who had been trained to keep animals in their right places, but to kill nothing except game and vermin, made no direct attack on the life of the boar. He laid hold of him by the ear, and that hold he kept till the boar, though much stronger and far heavier than the dog, was so completely subdued, as that *Trap* could lead him by the ear to his own place of abode. The dog had seldom occasion to lead him half way; but he used to watch his motions, and if the boar offered to return, the dog instantly went to meet him, and so punished his other ear, that there was no need for a second warning, at least during the next week.

One of the principal uses of the terrier as a hunting dog is to accompany the fox-hounds; and in cases where all the earths are not carefully stopped, a labour which it is not easy to perform in places where there is much cover, the terrier is indispensable, because his assistance is necessary in unearthing the fox.

SCOTCH TERRIER. This dog is generally low in stature, very seldom more than thirteen or fourteen inches in height, with a strong and muscular body, and short stout legs. His ears are small and half erected. His head is large in proportion to the size of his body, with the muzzle considerably pointed; he has an exceedingly acute scent, so that,

with certainty, he can trace the footsteps of all other animals. They are variously coloured, but generally of a sand colour, or black. Those which are thus coloured are certainly the most hardy, and can be depended on more. When pied or white, it is a rare sign of the impurity of the breed. The hair of the terrier is hard, long, and matted, over almost every part of the body. His bite is extremely keen. There are three distinct varieties of the Scotch terrier, namely, the one above described; another about the same size as the former, but with the hair somewhat flowing, and much longer, which gives a short appearance to the legs. This is the prevailing breed of the western islands of Scotland. The third variety is much larger than the other two mentioned, varying in height from fifteen to eighteen inches, with the hair very irony and hard, and not so long as that of the others. The best bull terriers have been produced from this breed. Amongst the higher order of sportsmen the terrier is preserved in its greatest purity, and with the utmost attention; and it seems of the greatest importance not to increase its size, which would render him unfit for the purposes in which he is employed, that of entering the earth, and driving other animals out of their burrows, for which his strength, make, and invincible ardour, peculiarly fit him.

THE ENGLISH TERRIER. In appearance this is a much more handsome dog than the Scotch terrier, being much smoother in the coat, and much more lively in the colours. Generally speaking, the back, the sides, the neck, and the top of the head and the tail, are black; and the belly, the throat, and a spot over each eye, clear reddish brown. The hair over the whole body is very strong, but short and glossy; the head is small, and the muzzle of moderate length; the ears are also small, partially erected, and turned over at the tips; the tail is rather short, and blunt at the end, so as to appear as if it had been shortened artificially; it is carried partially elevated, but not recurved. Dogs of this description are very common, and vary much both in their size and quality. The difference between the smooth glossy coat of this terrier, and the rough and wiry one of the Scotch, is another instance, in addition to that of the greyhound of the two countries, of the effect of a colder climate in roughening, and of a warmer climate rendering more smooth, the coverings of these animals; and it will be borne in mind, that there is the same difference in the wild dog of India, as found in the southern parts of that country, and in the mountains of Nepâl.

There are several other terriers named and described in the more extensive works on sporting dogs; but, though they differ in appearance, from climate and other circumstances, their general characters are everywhere nearly the same.

We shall now give a short account of those dogs which are generally used in shooting, and which are remarkable for the fineness of their scent, for their docility, the gentleness of their manners, and the strength of their attachment to man. Many of them are chiefly used in the capture of ground birds, such as partridges and grouse, and others chiefly in fowling for water birds; but they are so docile, so gentle in their manners, and often so handsome, that very many of them are kept as house or pet-dogs, and not a few are carriage companions of persons of high rank; and when they are so, they are honoured with a place inside, and not left to run like the spotted dog.

Each dog is in its element, however, in this; for while the great attachment of the riding dog is to the riders, that of the running dog is to the horses. When used in sporting, some of these dogs start or spring the game, while others merely point at it. The dogs which start game are generally called spaniels, but sportsmen often name them according to the kind of game which they are employed in raising.

SPANIELS. The chief difference between spaniels and the other dogs used in shooting is, that the spaniel gives tongue the instant that he scents the game, and by that means raises it, so that the sportsman may take aim at it on the wing, which is the only gentlemanly way of shooting winged game. They are comparatively weak dogs, and their bite is not very formidable, but they are exceedingly active. The *Springer*, or true spaniel, used in springing game, bears a considerable resemblance to the setter in shape, but is much smaller in size. The colours are red, liver-coloured, yellow, and white; their ears are very long, soft, and pliable, and covered with long and very silky and delicate hair; the tail hangs down, and is bushy, but it is in continual motion while they are hunting. The *Cocker* is much smaller, but far more lively and active than the spaniel, and he is so fond of sport, that he can be kept running the whole day long without apparent fatigue. Of the pet spaniels there are many breeds, of which King Charles's, and the Blenheim, or Marlborough, are among the most esteemed. Smaller sized than even these, there is an endless variety, but, except for their beauty and attachment, they are of but small value; though all spaniels, from their restlessness, and the proneness they have to give tongue on the



The Spaniel.

least alarm or noise, make excellent watch-dogs inside a house, they are too feeble and too delicate for being of much value out of doors during the night. There is one variety, however, which is an exception to this, and that variety is,

THE ALPINE SPANIEL, OR DOG OF ST. BERNARD. This is a dog far exceeding every other spaniel in size and strength, and also in beauty and sagacity. In the last respect, he is perhaps superior to every other dog. A full-grown one measures six feet from the point of the nose to the end of the tail, and stands at least two feet high at the shoulder. The offices which these beautiful and highly interesting dogs perform are very different from those to which the bloodhound has often been degraded; and the following account of their labours, services, and sufferings, will be read with interest:—

"The convent of the great St. Bernard is situated at the top of the mountain known by that name, near one of the most dangerous passages of the Alps, between Switzerland and Savoy. On these regions the traveller is often overtaken by the most severe weather, even after days of cloudless beauty, when the glaciers glitter in the sunshine, and the pink flowers of the rhododendron appear as if they were never to be sullied by the tempest. But a storm suddenly comes on; the roads are rendered impassable by drifts of snow; the avalanches, which are huge loosened masses of snow or ice, are swept into the valleys, carrying trees and crags of rock before them. The hospitable monks, though their revenue is scanty, open their doors to every stranger that presents himself. To be cold, to be weary, to be benighted, constitute the title to their comfortable shelter, their cheering meal, and their agreeable discourse. But their attention to the distressed does not end here. They devote themselves to the dangerous task of searching for those unhappy persons who may have been overtaken by the sudden storm, and would perish but for their charitable succour. Most remarkably are they assisted in these truly Christian offices. They have a breed of noble dogs in their establishment, whose extraordinary sagacity often enables them to rescue the traveller from destruction. Benumbed with cold, weary in the search for a lost track, his senses yielding to the stupifying influence of frost, which betrays the exhausted sufferer into a deep sleep, the unhappy man sinks upon the ground, and the snow drift covers him from human sight. It is then that the keen scent and the exquisite docility of these admirable dogs are called into action. Though the perishing man lies ten, or even twenty feet beneath the snow, the delicacy of smell with which they can trace him offers a chance of escape. They scratch away the snow with their feet; they set up a continued hoarse and solemn bark, which brings the monks and labourers of the convent to their assistance. To provide for the chance that the dogs, without human help, may succeed in discovering the unfortunate traveller, one of them has a flask of spirits round his neck, to which the fainting man may apply for support, and another has a cloak to cover him. These wonderful exertions are often successful; and, even where they fail of restoring him who has perished, the dogs discover the body, so that it may be secured for the recognition of friends; and such is the effect of the temperature, that the dead features generally preserve their firmness for two years. One of these noble creatures was decorated with a medal, in commemoration of his having saved the lives of twenty-two persons, who, but for his sagacity, must have perished. Many travellers who have crossed the passage of St. Bernard since the peace have seen this dog, and have heard, around the blazing fire of the monks, the story of his extraordinary career. He died about the year 1816, in an attempt to carry a poor traveller to his anxious family. The Piedmontese courier arrived at St. Bernard in a very stormy season, labouring to make his way to the little village of St. Pierre, in the valley beneath the mountain where his wife and children dwelt. It was in vain that the monks attempted to check his resolution to reach his family. They at last gave him two guides, each of whom was accompanied by a dog, of which one was the remarkable creature whose

services had been so valuable to mankind. Descending from the convent, they were instantly overwhelmed by two avalanches, and the same common destruction awaited the family of the poor courier, who were toiling up the mountain in the hope to obtain some news of their expected friend. They all perished. A story is told of one of these dogs, who, having found a child unhurt, whose mother had been destroyed by an avalanche, induced the poor boy to mount upon his back, and thus carried him to the gate of the convent. The subject is represented in a French print."

The WATER SPANIEL is even a more attached animal than any of the land ones. There are two principal varieties, the *great* and the *small*, or *poodle*. They do not differ very much in appearance, only their heads are rather larger and rounder than those of the land spaniels, and their hair is longer, and more curly and silky.

The following is one of the most remarkable instances of fidelity in this most attached of all the canine race; and though it has been frequently in print, we give it without the least hesitation:—

"A few days before the overthrow of Robespierre, a revolutionary tribunal had condemned Monsieur R., an ancient magistrate, and a most estimable man, on pretence of finding him guilty of a conspiracy. Monsieur R. had a water spaniel, at that time about twelve years old, which had been brought up by him, and had scarce ever quitted his side. Monsieur R. was cast into prison, and in the silence of a living tomb he was left to pine in thought under the iron scourge of the tyrant, who, if he extended life to those whom his wantonness had proscribed, even until death became a *prayer*, it was only to tantalise them with the *blessing* of murder, when he imagined he could more effectually torture them with the *curse* of existence.

"This faithful dog, however, was with him when he was first seized, but was not suffered to enter the prison. He took refuge with a neighbour of his late master's. But, that posterity may judge clearly of the times when Frenchmen existed at *that* period, it must be added, that this man received the poor dog tremblingly, and in secret, lest his humanity for his *friend's* dog should bring him to the scaffold. Every day, at the same hour, the dog returned to the door of the prison, but was still refused admittance. He, however, uniformly passed some time there. Such unremitting fidelity at last won even on the *porter of a prison*, and the dog was at length allowed to enter. The joy of both master and dog was mutual; it was difficult to separate them; but the honest jailor, fearing for himself, carried the dog out of the prison. The next morning, however, he again came back, and once on each day afterward was regularly admitted by the humane jailor. When the day of receiving sentence arrived, notwithstanding the guards, which jealous power, conscious of its deserts, stations around, the dog penetrated into the hall, and couched himself between the legs of the unhappy man, whom he was about to lose for ever.

"The fatal hour of execution arrives; the doors open; his dog receives him at the threshold! his faithful dog *alone*, even under the eye of the tyrant, dared to own a dying friend! He clings to his hand undaunted. 'Alas! that hand will never more be spread upon thy head, poor dog!' exclaimed the condemned. The axe falls! but the tender adherent

cannot leave the body; the earth receives it, and the mourner spreads himself upon the grave, where he passes the first night, the next day, and the second night. The neighbour, meantime, unhappy at not seeing the dog, and guessing the asylum he had chosen, steals forth by night, and finding him, caresses and brings him back. The good man tries every way that kindness could devise to make him eat; but, in a short time, the dog escaping, regained his favourite place. Every morning, for three months, the mourner returned to his protector merely to receive his food, and then returned to the ashes of his dead master! and each day he was more sad, more meagre, and more languishing.

“His protector, at length, endeavoured to wean him; he tied him; but what manacle is there that can ultimately triumph over nature? He broke or bit through his bonds; again returned to the grave, and never quitted it more. It was in vain that all kind means were used to bring him back. Even the jailor, who had witnessed the strength of his attachment, used to carry him food; but his affection for his master seemed to strengthen as his frame became weaker; and sometime after he had ceased to take any nourishment, he began digging his own grave in the earth which covered the remains of the object of his attachment, continuing in the feeble performance, till he expired half buried in his master's grave.”

There are two very favourite varieties of dogs, which though not exactly spaniels, are yet very nearly allied to them in their attachment, their playful dispositions, and their aquatic habits. These are the great rough water dog and the poodle. The first is a variety of which the origin cannot be very clearly traced; the second is understood to be a cross between the first and the cocker. These two resemble each other in their covering, and also in their fondness for swimming and their dexterity in diving. The hair of both is very long, and if left uncut, twists into pendent ringlets, while the curl on the water spaniel is short and crisp like the curls of a wig. By this means it is easy to discriminate the spaniel from the other two; and the different texture of the hair makes it as easy to distinguish the water-dog from the poodle. The hair on the water-dog is strong and rough, and that on the poodle very silky, about the same in texture as that of the cocker. They are all sometimes called poodles; they are deservedly favourites as pet dogs; and they are often trimmed lion-wise, with only a mane, a tuft on the tail, and one on each of the heels.

The *water-dog* is a highly useful animal in all aquatic situations or on board ship. He is never so much in his element as when he is fetching and carrying. He brings game to land, recovers light objects that are let overboard at sea, and will plunge into pretty deep water, and fetch a stone from the bottom; they carry gloves, sticks, and other matters, and they will return for any thing if they have been previously shown it. This dog is of various colours, but not unfrequently black, with the hair fading into brown at the points.

The *poodle* is, generally, smaller than the water-dog; and its soft silky fur gives it a more delicate appearance. It is very playful, and swims and dives well, though it is, perhaps, inferior in these respects to the other. It is often of very small size and beautifully white in the colour, with eyes as black as jet, and very intelligent in their expression. In this form it is an especial pet.

SETTERS AND POINTERS. The habits of all these dogs are nearly the same; and though they are not so docile, gentle, and affectionate, they are indispensable to all who wish successfully to beat the fields or the moors for sport with the gun. They are dogs of fine scent and admit of very high training. They are silent dogs, and beat or quarter the ground with great activity, discovering the game by scenting the air, standing still at a dead point without moving any part of their bodies when they have discovered it, and after the gun is up and the game down, fetching it to their master. As there is some skill required in breaking or training them properly, a thorough good one is of considerable value. If the dog is not properly trained he is apt to make false points, that is, to point at small birds and other things not worth powder and shot; and not only at these, but also at the forms or places where game has recently been.

The *setter* is understood to be an English dog. It is smaller than the pointer, and not so showy, but it is said to have a better nose, and to be less liable to injury in the feet while beating hard and stony ground. When put to work in enclosures, the setter generally beats round close under the hedges before he begins to quarter the field in breadth. There are two named varieties of setter, independently of the numerous breeds. Indeed, as they are mongrel dogs, produced by crossing, chiefly between spaniels and pointers, the varieties of them may be multiplied without limit. Their hair is, in general, beautifully curled. There is, however, a good deal of trouble in breaking setters, and they cannot be always trusted to after they are broke. Their propensity to stand and point is not pure; for they have it only as they have the blood of the pointer in them; and in as far as they have the blood of the spaniel, their propensity is to give tongue and put up the game. Of course in the natural state of the animal these opposite propensities weaken each other; and it is only by careful training that the one can be rooted out and the other established. But if this is once done, the setter is a very valuable dog; and though smaller than the pointer, it quarters the ground faster, and can continue longer.

POINTERS. Of these there are several varieties, independently of breeds. In their general form, pointers bear some resemblance to hounds; but the muzzle is shorter, the ears smaller, and partly erect and partly pendulous; and the difference of appearance between them and setters may be observed in the portion of the spaniel character which is necessarily possessed by the latter. The *Spanish* pointer is the finest of the whole, and the greatest care is taken by those interested to preserve this breed as pure as possible. His natural tendency is to be silent and to point; and therefore he not only requires much less training than the others, but is much more sure and steady in his point; and he is at the same time very obedient and docile. He has the disadvantage, however, of being very delicate, both in respect of fatigue and of management; and thus, though a very fine dog, he is rather an expensive one. As a dog for the rough moors, he is inferior to the setter, as he is unable to endure the fatigue of a long morning, and his feet are very liable to be injured. The *English* pointer is a cross between the Spanish and fox-hound and harrier; and though in consequence of this he is more difficult to break than the Spanish, he is upon the whole a more valuable dog for general purposes. He is very handsome, remarkably docile,

and when he is properly trained, his nose is very good. In the south of Germany there is a very small breed which is an exact miniature of the English pointer. The *Russian* pointer is very like the Spanish one in form, except a remarkable peculiarity in the nose, which is so deeply cleft as to appear cut in two, and to procure him the name of the double-nosed pointer. There are various other pointers, and the varieties of the English one in shape, size, and colour, are almost endless.

We shall now briefly notice a few of those dogs of the second division, which are used for domestic purposes, though some of them are ready enough to take game if it comes in their way.

THE NEWFOUNDLAND DOG. This is a noble animal, and, with the exception of the water spaniel, it takes the water much more readily than almost any other dog. The feet of this species are webbed. Indeed, when of pure blood, the Newfoundland is the prince and honour of the race. His size and strength are great, and his look dignified, so that those who are not accustomed to him are apt to be afraid of his approach; but he is exceedingly mild, and has at once the most beautiful and expressive eye of all the race. Unless under very extraordinary circumstances of provocation and necessity, he is never the aggressor; and though many large dogs are very prone to tyrannise over the smaller ones, he has no such habit, but will bear considerable indignity rather than fight with any dog of insignificant appearance. A full grown Newfoundland dog of the pure breed, and that has received proper treatment, measures six feet and a half from the nose to the tail, the length of that appendage being two feet, and very handsome both in its form and in the style in which it is carried.



The Newfoundland Dog.

From the one fore foot to the other, over the shoulders, five feet eight inches; girth behind the shoulders three feet four inches; round the head across the ears two feet; the upper part of the fore leg measures ten inches; the length of the head fourteen inches; and from his feet being webbed, he can swim with great ease, and for a very considerable time. His body is covered with long shaggy hair; his legs are feathered, and he has an extreme villous tail which is curvilinear. The Newfoundland dog is but of recent introduction into this country from the island whose name he bears, and may be considered as a distinct race. He is docile to a very great degree, and nothing can exceed

his affection. Being naturally athletic and active, he is ever eager to be employed, and seems delighted in performing any little office required of him. From the great share of emulation which nature has given him, to be surpassed or overcome would occasion great pain to him. On every emergency he is active, the friend of all, and is naturally without the least disposition to quarrel with other animals; he seldom or never offers offence, but will not receive an insult or injury with impunity. Such is the capacity of his understanding, that he can be taught almost any thing that man can inculcate, of which his own strength and frame are capable. His sagacity can only be exceeded by his energies, and he perseveres with unabated ardour in whatever manner he is employed, and while he has a hope of success he will never slacken in his efforts to attain it. The amazing pliability of his temper peculiarly fits him for man's use, and he never shrinks from any service which may be required of him, but undertakes it with an ardour proportionally to the difficulty of its execution. He takes a singular pride in being employed, and will carry a bundle, stick, or basket, in his mouth, for miles, and to deprive him of either of these is more than a stranger could with safety accomplish. Sagacity and a peculiarly faithful attachment to the human species are characteristics inseparable from this dog, and hence he is ever on the alert to ward off impending danger from his master, and to free him from every peril to which he may be exposed. From the astonishing degree of courage with which he is endowed, he is ever ready to resent an insult or to defend his friends, even at the hazard of his own life. Inclined habitually to industrious employment, such dogs are as useful to the settlers of the coast, from which they are brought, as our galloway and ponies are to us. It is easy to accustom them to daily labour. From three to five of them are harnessed to a sledge, or other vehicle, containing a load of wood or lumber amounting to twenty or thirty stones, which they will draw very steadily for miles with ease, and will do this without the aid of a driver, when acquainted with the road; and having delivered their burden, they return home to their masters, and receive, as a reward for their labour, their accustomed food, which generally consists of dried fish, of which they are said to be extremely fond. Indeed, the qualifications of this dog are very extensive. As a keeper or defender of the house, he is far more powerful and intelligent, and more to be depended upon than the mastiff, and has been much substituted for him in England of late years; he may indeed with great propriety supersede that breed. For his services upon navigable rivers and as a watch dog, none can come in competition with him; and many sportsmen have introduced him into the field with great success as a pointer, his sagacity and kindness of disposition rendering it an easy task to train him. Although this variety is styled the Newfoundland dog, there is every reason to believe that it was not found in that island when first visited by Europeans; and in corroboration of this it may be observed that it does not resemble the Arctic dogs properly so called, which are dogs with very shaggy hair, and much more ferocious in their dispositions, although, like this one, they are employed in labour. It has been said that this is a cross between some sort of English dog and a she-wolf of Newfoundland; but what species of English dog would, with a she-wolf, have produced a dog of the size, shape, and disposition of the Newfoundland, and at

the same time web-footed, it is not easy to say; and therefore we strongly suspect that the origin of this highly interesting breed must remain for ever doubtful.

ARCTIC DOGS. In all those places of the polar countries, near the ice, which are not adapted for the pasturage of the reindeer, the dog is the most valuable domestic animal. These dogs have all a strong family likeness; and they all have the muzzle rather elongated, the ears erect, the legs and loins very strong, and are otherwise fitted for enduring great fatigue. These dogs have been named after the countries in which they are found—the *Siberian* dog, the *Iceland* dog, the *Greenland* dog, and the *Esquimaux* dog; but the differences among them are not greater than we find among dogs of the same nominal variety in this country. In those dreary regions, where winter prevails fully three-fourths of the year, it would be impossible for the inhabitants to exist were it not for these dogs; and the faithful animals, in performing their labours in drawing the sledges over the snowy deserts, are often subjected to the severest privations. Marco Polo, the celebrated Venetian traveller of the thirteenth century, distinctly speaks of a country in the north of Asia, difficult of access on account of the intermediate mud and snow, from which great quantities of furs were carried in vehicles wanting wheels by means of dogs. The information he received on the subject characterises the sledges of Greenland or Kamtsehatka, now drawn by these animals. In this latter country the species employed is of a middle size, of various colours, white, black, grey, or black and white, of wolfish aspect, yet not unlike the shepherd's dog or its mongrel offspring. Its hair is rough, its tail recurved, and the ears pointed; it cannot be taught to hunt, and never barks, but howls. Though regularly trained to the draught, the dog of the Kamtschadale and Greenlander seems less tractable and domesticated than that of civilised countries, proving perhaps how much its nature is modified by associations with man. All that are thus occupied are castrated, to preserve them more under controul. During the prevalence of ice and snow, from five to ten of them are harnessed to a light wicker-work sledge, about three feet long and one in breadth. The driver is supported by a seat a yard above the ground, and the whole frame rests on two curved pieces of wood or sometimes whalebone, which operate as skates in gliding over the frozen snow. The total weight of the sledge does not exceed ten pounds, in which journeys incredibly long are safely accomplished. The harness is made of leather, the dogs are arranged in pairs, commonly with a leather along the whole in front, and are fastened together by straps or reins through their collars, fixed by a hook and chain to a ring in the fore part of the sledge. If the journey be difficult, or the burden heavy, the number of dogs is increased; and when M. Lesseps brought the despatches of La Perouse over land from the harbour of Petrapowloski, thirty-seven dogs were harnessed to his sledge, and forty-five to that of the companion of his journey, the Governor-general Kasloff. Thirty-five sledges were in company, drawn by nearly 300 dogs. But journeys of this description, though generally successful, are not entirely void of danger. The traveller, whose position is sidewise, and not directed forward, must be careful to preserve the equilibrium of so slight a vehicle; if it inclines to the right, he must lean to the left, and his posture must be changed when the

inclination is reversed. The utmost vigilance is necessary not to be overset, and if this accident should occur he must hold vigorously by the sledge, as the dogs once in motion run straight forward, and with greater ardour on their burden being lightened. They are scarce to be restrained on the open way, and on descending deep declivities. Kraschenonikoff affirms that they are liable to be unyoked from the violence with which they rush down. They likewise become unruly on scenting deer, or hearing dogs in the neighbouring villages. Much of the security of the traveller depends on the training of the leader, and the whole are guided by the voice and a crooked stick, without any whip. But the fatigue of long journeys is so great, that the dogs frequently perish under it; food is scanty, and shelter rarely to be obtained. Of the 300 dogs employed by M. Lessep's party, in crossing the peninsula of Kamtsehatka, only twenty-seven at last remained; many died of want and exertion, the others, when tied up, ate the cords and harness from hunger, and some devoured the carcases of those that had perished.

PASTORAL DOGS. Though these have not the same strength as the dogs which are used for draught, and are far from being the most handsomely formed of their race, they are intelligent, tractable, faithful, and highly useful in every situation where their services are required. There are many breeds and climatal varieties of them in different countries. In Britain there are two principal ones; the one of them a sheep dog, and the other more of a cattle dog; but as these dogs are kept very indiscriminately by the country people in the less cultivated districts, there are many mongrel breeds which want the more valuable qualities of the true one. In the case of both too, there are two divisions, tending dogs and driving dogs, which have been perhaps separated from each other by the different labours in which they are employed.

In the richer parts of the country, where the land is divided into inclosures, the tending dogs are less wanted; but in the wild parts, where the land is pastured in breadth, and where the labour of the shepherd or the herdsman, in attending to all the individuals of the herd, would be intolerable or even impossible, they are of the greatest value; and neither the proper care of the flock nor that of the herd could be rightly managed without them. They are not so much wanted in those places where sheep and cattle are fattened, because there it is desirable that the animals should be subjected to as little motion as possible, in order that they may be fit for the table in the shortest time possible. In the breeding districts it is different. Proper exercise is necessary to the full development of the animal, and to that soundness of constitution, by means of which alone it can be of the best quality when fattened; and as the pastures there are wide, the dogs are indispensable for fetching in strays, and keeping the flock together.

There is a peculiarity of structure in the feet of these dogs which is worth attending to, as an instance of how beautifully nature adapts every creature for the office which it has to perform; though this peculiarity is not confined to these dogs, but belongs to them in common with the spaniel, the pointer, and all dogs which have the habit of preying upon ground game without running it down in the chase. This peculiarity consists of a greater or smaller number of supplemental toes or appendages at the posterior part

of the foot, technically known by the name of "dew claws." These are soft and pendent, and do not act by means of muscles, like the toes, properly so called, but are a sort of fringe to the back part of the foot. In walking on hard surfaces they are of no use; and as they are liable to be torn and lacerated in beating among bushes, and thus to cripple the animals,—for wounds in the feet of dogs are more injurious to them than in any other part of their bodies,—they are cut off in sporting dogs when very young; but in shepherds' dogs, and in pastoral dogs generally, they are allowed to remain; and in the hill pastures especially, which are interspersed with bogs, and places between the hummocks of grass which consist of soft and sludgy peat, these dew-claws, by spreading out to their whole length by a little pressure, greatly extend the surface of the foot, and thus enable it to bear up the animal in situations where it otherwise would sink, in the same manner as people furnished with snow shoes, can walk over snowy surfaces, in which, if they had not these means of protection, they would sink knee deep. This peculiarity is found wanting in all the coursing dogs, and in all those which, in a state of nature, find their prey upon the firm ground.



Shepherd's Dog.

In the shepherd's dog, the ears are erect, as they are in the wild dogs, and, as in these, the muzzle is sharp. The character of the coat, too, indicates that they are mountaineers, or tempered to abide the severity of the weather. In all the varieties of dogs which we have had occasion to mention as extending over great range of climate, whether in latitude or in difference of elevation, it will be borne in mind that as we get into the colder climate, whether that is caused by difference of latitude or by difference of elevation, the coat of the animal in the cold climate is long and shaggy in proportion to that of the warm. A very remarkable instance of this may be perceived on referring to the plate of dogs, where the dog of Nepâl, or Thibet, and the dog of India, which are really the same variety, are figured. The Indian one will be observed to have a smooth and close coat, while the dog of the mountains is as shaggy as a bear. So also in the dog of the Mackenzie River, which is also figured, the covering will be observed to be particularly shaggy; whereas the very same dog in the warm parts of America has his clothing perfectly smooth. In the shepherd's dog this accumulation of

the fur is most conspicuous on the under part of the tail, the back, and the fore legs; but the production of hair varies considerably in different places; the shepherd's dog of the mountains being much more shaggy than the same animal in the plains. This intelligent and useful animal is one of the most obedient, serene, and placid members of the canine race. He is ever alive to the slightest indication of his master's wishes, prompt and gratified to execute them; and he appears to enjoy the greatest delight when employed in any useful service. By nature formed with an instinctive propensity to industry, he is never more pleased than in exerting his talents for the benefit of man, and in giving constant proofs of his inviolable attachment. The patience, native calmness, and devoted faithfulness of the shepherd's dog, render him insensible to all attractions beyond the arduous duties connected with the flock under his care. When once properly trained, he not only becomes perfectly acquainted with the extent of his beat, but also with every individual in the flock; he will very correctly select his own, and drive off those that encroach on his boundary. This will appear the more extraordinary when we consider the vast extent of country and the numerous flocks committed to a single shepherd's charge, which duty he could not possibly perform but for the invaluable services of this very sagacious animal. A word or signal from him will direct the dog so as to conduct the flock to any point required, and that signal he will obey with energy and unerring certainty. The labour of a shepherd, with the assistance of a dog, is comparatively an easy task; but without one we can hardly suppose an occupation more arduous. Without, indeed, the aid of this animal, it would be next to impossible to collect the flocks in those extensive and precipitous tracts of mountain-land where sheep delight to graze, and which are in many places quite inaccessible to man. The shepherd's dog, from being inured to all weathers, is naturally hardy; and, accustomed to hunger and fatigue, he is the least voracious of the species, and can subsist upon a scanty allowance. If a shepherd is travelling with his flock to a distance, his dog will only repose close to his feet; and should he wish to leave them for the purpose of taking refreshment, he has only to intimate his intention to his dog, and he will guard the sheep in his absence with as much care, and keep them within due bounds, as well as he himself could have done. Although left alone for hours, a well-trained dog always keeps the flock within the limits of a made road, even, should there be no fences; he watches every cross path and avenue that leads from it, where he posts himself until they are all past, threatening every one who attempts to move that way; and, should any of them escape, he pursues them, and will force them back to their companions without doing them any injury. The breed of this dog is preserved with the greatest attention to purity in the north of England, and in the highlands of Scotland, where his services are invaluable. The shepherd's dog of this country, with all his good qualities, in point of size and strength, is still greatly inferior to those of the Alps, and of that extensive range of mountains which divide France from Spain, as well as to the variety which is found in the neighbourhood of Caucasus.—In this country there are two kinds of this dog: that used by shepherds, which is of a small size, and the breed used by drovers and butchers. About London,

and in many parts of England, the drover's dog, which is chiefly used in driving sheep, is without any tail: this, however, is not the natural form of the animal; for the tail is destroyed when very young, not by cutting off, but by extracting the bone, which is technically called "stringing," and is generally performed by pulling out that part with the teeth. After this the fleshy part of the tail contracts to a mere tubercle, and is wholly concealed among the shaggy hair of the animal. Dogs which are treated in this manner are said to endure much more exertion with less fatigue than those in which the tail is entire; and whether this be the fact or not, the degree of fatigue which those dogs can undergo is truly astonishing. Nor is their sagacity less wonderful, for they can divide the drove into any sections that may be required, drive one section one way, and another another way, whatever may be the number, and after the sections are once parcelled off to the purchasers, they can bring back again with the most unerring certainty any individual which has left its section, and joined another. These offices are generally performed by barking and manœuvring alone, without touching the sheep with the mouth; or if that operation be necessary, the dogs merely lay hold of the sheep, and force them into the intended direction, by holding the wool without biting the skin or even separating that portion of the wool of which they take hold.

Indeed, in all situations, the shepherd's dog conducts matters chiefly by his voice, or what may be called the word of command; and he is not more skilful in giving his own commands than he is apt in receiving the commands of his master. In which way those commands are understood, is no easy matter of explanation; but the fact is certain, that a skilful shepherd can send his dog, if a thorough-bred one, to the flock, a mile distant, on the opposite hill, and make him separate from the rest, and bring any number, and, as it is said, any particular individuals that he may be directed to bring. The matter is entirely above our comprehension; but the fact is certain, that these dogs know and can distinguish every individual sheep of the flock, to the charge of which they are appointed; and in situations where sheep are folded for the night, if even one sheep is missing, the dog will, without being instructed, return and beat the pasture for it; and if he finds that it has stuck in the mire, or otherwise got into any situation from which it cannot extricate itself, he returns to the shepherd, and, by the style of his barking, indicates that assistance is required, and leads the way to the place where the distressed sheep is, with as much certainty as any pilot or other human guide. This peculiarity is not confined to the shepherd's dog; but belongs to it in common with various others of the more social dogs, or those which are more closely attached to mankind; and there are innumerable instances of dogs, when they themselves have failed in rescuing persons from perilous situations, going in quest of human assistance, and indicating by the earnestness of their cries, that that assistance was immediately and urgently required. The case of the London firemen's dog, Billy, may be mentioned as a very remarkable one. That animal was the first to find out any fire that occurred; he collected persons to assist; and though he of course could not actually put his paw to the engines, yet he was so full of bustle and activity, and so encouraged every one who was working by the earnestness of his commendations, that there is no question but that he was the means of saving a great deal of property; for

even a dog doing his duty in so disinterested, devoted, and hearty a manner as it was done by honest Billy, was enough to put to shame any one who refused to lend a helping hand. We mention the case of this dog, because it shows that those animals might be trained to far more useful purposes than any to which they are usually applied, valuable as many of these are, and those of sheep-tending, and sheep-driving dogs in an especial manner. When we consider that one good shepherd's dog performs services which could not be performed by twenty shepherds in a flock, which one shepherd can easily manage with the assistance of the dog; and, when we farther consider that without the dogs, it would require many times the number of men which are now employed to bring sheep to the markets, and divide them off to their respective purchasers, we are within the mark when we say that we eat our mutton full twenty per cent. cheaper in consequence of the labours of the shepherds' and drovers' dogs.

THE CUR. This dog's name is rather at a discount, and he is considered a snarling and ignoble animal; but still he is a very useful and very faithful creature. He is the watch-dog of the cottager, the playmate of cottage children, and the associate and defendant of labouring people and their property; and while the man is stripped and at work, if his faithful cur, or *colly*, as he is called in some places, takes post upon his coat, that coat is as safe as if it were under lock and key. There is also a softening of the heart produced in the labourer when he shares his lonely meal with his little dog; and, as the dog is in the field with him in all weathers, wet and dry, it is not easy to say to what extent he cheers and encourages the man, and promotes as well as lightens his labour.

But it is not in such situations alone that this dog is valuable; for he is in an especial manner the cattle dog, and of the utmost value in all those places where the country is grazed in breadth, because there he brings in the stray cattle with the same certainty and the same success as the shepherd's dog brings in the stray sheep. It is worthy of remark, that those dogs which are useful in the management of domestic animals never attempt to make their attacks on a vital part, or on any part where a bite would be of serious injury. The mastiff flies at the throats of cattle, and the bull-dog attempts to seize them by the nose, and suffocate them, something in the same way as the jaguar is said to do with the wild cattle in South America; but the curs, and other true cattle dogs, never attack any beast in front. They invariably snap at the heels, and pinch that part which answers to what is called the "funny bone" in the human elbow, and upon which even a moderate pressure with the fingers causes an acute momentary pain. One might very easily suppose that there is an original instinct for driving cattle without biting them in these dogs. When they snap at the heels, they seldom if ever draw blood; and they snap at the one heel or the other, according to the direction in which they wish to turn the animal. Any one who has attended to the habits of animals must have observed that they always run upon that which gives them pain. If a horse in battle is slightly wounded by a bayonet, he will run upon it to his certain destruction; and man himself is not exempted from this propensity; for, if a bayonet once wounds a man in battle, so far as to give him pain, he is almost certain of running himself through upon it.

How dogs become aware of this propensity in animals it is impossible for us to ascertain, because we do not know the notions by which animals are governed in their instincts. Indeed, the subject is one of those upon which all inquiry is vain, inasmuch as we are not in possession of anything similar, in our own experience, which we can compare to it. We know nothing experimentally of the operation of instinct unconnected with reason; and, in consequence of this, we can never come to any satisfactory conclusion with regard to the motives or foundations of action in animals. But, notwithstanding this, the facts are undoubted; and there is no fact better made out, or more wonderful in its cause, than the tact of these dogs in the driving of cattle. If they wish to turn the beast either to the right or the left, they pinch the heel only on that side towards which they wish to turn it, and the degree of their pinching is equal to the right of turning which they wish to effect. The beast also, itself, in so far seconds the action of the dog, because it brings round its head towards that side on which the pain is felt, and the joint action is sufficient to turn the beast fairly round, and force it off in the opposite direction before it has advanced more than its own length. If the object, however, is to drive the beast straight forward, the snapping is made alternately at both heels, and so long as it is continued, the beast advances with a yawing motion, until it is brought to the proper speed in the proper direction, and then the dog ceases to trouble it.

This driving by the heels is a very valuable character in those dogs, inasmuch as it is quite impossible to drive cattle by attacking them in the head. In that case they offer battle, or, at all events, defensive hostilities, from their instinctive tendency to guard themselves from injury in that quarter. Hence, when it is attempted to drive cattle by dogs which assail either the throat or the nose, the cattle are invariably driven wide, or separate from each other, and the labour of the dog is worse than useless.

The cur is, probably, a variety, in part connected with, or derived from, the shepherd's dog; but it differs from the shepherd's dog in its being smooth in the hair, while the shepherd's dog is invariably shaggy. The legs are considerably longer in proportion to the size of his body, which is a good deal larger than that of the shepherd's dog, and is stronger in the make, with the ears half pricked, and a tail having a natural tendency to be short. Great attention is paid to the breeding of this dog in the north of England and southern counties of Scotland, as he is found to be a very useful and trusty servant; and great care is also devoted by breaking him in for that purpose. Being a very sagacious dog, he soon acquires a knowledge of his master's fields, which he watches with the utmost vigilance, and is particularly attentive to the cattle that are in them, watching all their movements and regularly going his rounds; and should any strange cattle appear among the herd, he will fly at them with great ferocity, and force them immediately to quit the pasture they are trespassing on. The general colour of this dog is black and white; but it may occasionally be met with all black, and sometimes it may be found all white. As, however, there is less attention paid in most places of the country, to the purity of this breed of dogs than to that of any other, the mongrels related to the curs, and used instead of them, are exceedingly numerous, so much so, indeed, that no account can be given of them.

There are several breeds of dogs connected with those of the present division, and perhaps, also, with those of the former, which it may be necessary to notice. The principal of these are the following:—

The Lurcher. This is a dog which hunts singly, and finds his game indiscriminately by the scent or the eye. It bears some slight resemblance to the hound, but its limbs are shorter and stronger in proportion; its form is much less elegant, and its motions much more slow. The head is thicker and not so much pointed; the ears are short, erect, and half pricked up; and the whole body is covered with coarse and shaggy hair, which is generally either of an iron-grey or a dull sand colour. This is a sneaking species of dog, and prone to lie in wait for his game; and, therefore, he is a favourite dog with poachers, who employ him under cover of night, in the capture of hares and rabbits, and occasionally winged game. He is not much esteemed by regular sportsmen, and his very name is one of dishonour; but within his sphere of action, the lurcher is a very sure and trust-worthy dog.

The Leymmer is a dog whose memory is almost forgotten; he was understood to be the produce of a cross between the greyhound and common hound, or talbot, partaking of the qualities of both with some additional ones of his own in supplement. Indeed, it almost invariably happens that, in cross breeds of dogs, if both parents are thoroughly bred, there are new and often very good qualities obtained by the cross. The leymaner possessed much of the swiftness of the greyhound, together with a keen sense of smell, and he was, perhaps, more hardy than either of the breeds of which he was the joint production. It is, indeed, a very general case that cross-bred animals are much more hardy than either of the parents between which they are crosses; and they are so whether they be what we call perfect animals, as is the case in most if not all of the mongrel breeds of dogs, or hybrids, which do not breed with each other, although they breed back to the pure blood, as is the case with the mule, between the horse and ass. This dog, notwithstanding his strength, his swiftness, and his power of endurance, had some of the stubbornness of the mule about him; and it was necessary to confine him in a thong, and let him slip after the game had started, otherwise he would have run broad, and been quite ungovernable.

The Tumbler. This is also a mongrel dog, though of what parentage is not very clearly ascertained. He is considerably less than the greyhound, with a long and lean body, and erect ears, but with the head more resembling the greyhound than that of the lurcher does. Still, however, his action is in many respects similar to that of the lurcher. He does not run his game fairly down in straight forward chase, like the greyhound, but practises arts, and shows a great deal of sagacity in catching it upon the double. In order to do so, and to betray the game into doubling nearer to him than it otherwise might, he counterfeits falling down or being crippled, until the game on the return of the double comes within his reach; and then he pounces upon it with a single bound much greater than that of almost any other dog. It is from this habit of crouching and waiting the double, which he does with great dexterity, that he gets the name of tumbler; and though he is far from being one of the most elegant or graceful dogs in coursing, he is by no means one of the least successful.

The Turnspit. It is somewhat difficult to define to what other race of dogs these are most nearly allied. They are, perhaps, the least graceful of the whole tribe. Their bodies are long, their legs remarkably short, and they are prone to become exceedingly fat, as they are very lazy. They have, however, some good qualities. The following are a few of their leading characters:—the head is rather large in proportion to the size of his body: for the most part it has a peculiarity in the colour of the eyes, one of which has the iris of one eye white and the other black. The Turnspit is to be met with of all hues, but the most usual one is a kind of bluish-grey, spotted with black,—sometimes he is found of a slate colour. The shape of the head is something between that of the hound and pointer, with long ears. One variety of the Turnspit has straight legs. He is a bold, spirited, and vigilant little dog; its services in Great Britain at one time were very much valued, but by the invention of machinery his work has been superseded: he is, in consequence, becoming extremely scarce, and in all probability will very soon become extinct, although in Germany and France he is still used in the kitchen. Turnspits that take their hours for labour in regular rotation, know very well how to distinguish the roasting days from the rest; and it is with some difficulty that they can be made to work on the latter, as if they had a notion that it was then a duty that they were not in duty bound to do. Several instances are recorded of dogs distinguishing the days of the week; for in the neighbourhood of some towns there are dogs that regularly repair thither for market days, because they know that they can procure some booty then.

The varieties of mongrel breeds in this division of dogs are, however, endless, so that it would be impossible to give any account of them, though they are all less or more attached to mankind, and capable of evincing affection in some way or other. But in towns, where the breeds of dogs are miscellaneous, these are apt to be mongrel curs, of very vicious character, which do not either benefit their keepers, or tend to place the race in a favourable point of view.

III. **SHORT-MUZZLED DOGS.** The dogs of this division are different in their characters from those of either of the former; and the differences are so striking, that it is by no means easy to suppose that they are of the same original race either with the dogs that have the elongated muzzle, or with those which have it of medium length. It is somewhat remarkable, that among dogs which are in what may be called a state of nature, there is no approximation to the short muzzle; but the origin of this race is so obscure that nothing can be said respecting it with any certainty. They differ from each other according to the breeds and kinds as they are described; but there are certain characters which belong in common to the whole of them. They have not the swift motion of the long-legged dogs, neither have they the affectionate manners and playful dispositions of most of those of the second division; and if the epithet "dog" is to be considered as a synonyme for surliness, this is the division of the canine race which are dogs by way of eminence; and they are the only ones to which the French, who are not unhappy in their nomenclature, give the name of *dogues*. These dogs are often faithful, vigorous protectors of the property of their masters; but they show no kindness or affection. The larger ones are very

formidable, and even dangerous animals; and the small ones, which are sometimes kept as pets, have little feeling of gratitude, and are always snappish to every body except those by whom they are immediately fed; and even to them the attachment does not appear to extend much beyond the selfish consideration of being fed.

The dogs of this division are of no use whatever in the chase, or in any way in shooting or hunting; they are not swift, their noses are very inferior, and their only good qualities are the strength, the severity of their bite, and the firmness with which they retain their hold. As used against domestic animals, in keeping them to their proper places, and turning them in any direction which may be wished, they are not efficient, neither are they safe. They do not drive the animal, as is the case with sheep-dogs and curs, but always attack it in front, attempting to seize its nose or tear its throat. They are, in fact, slaughtering or tearing dogs; and they can be used only in those characters, and not in that of friends, companions, or assistants in any one labour. They are good only for an attack; and, therefore, some of them have been employed in the most cruel and savage of those occupations of the profligate which are very absurdly named sports.

It is a curious fact that dogs of this description should be known only in a state of domestication.—Some of the wild dogs are savage enough in their manners; but there is none of them so savage, and we may add, none of them so destitute of what might be called intellect in animals, as these short-nosed dogs. It therefore becomes a curious question how these races originated, and by what particular kind of treatment on the part of man, all the nobler qualities of the dog were merged in the single one of trustworthy ferociousness. Nor is it less a matter of curiosity, if we could unravel it, to ascertain why, along with this character, dogs of this division should have greater strength and more determined powers of endurance, than any of their more attractive brethren. This question we have unfortunately no means of solving; because, though we know the origin of particular breeds we do not know the source whence they were derived, or the means by which they have been made to differ so much from the rest. It is also singular that, along with this departure from the swift motions of dogs of the first class, and the endearing dispositions of dogs of the second, there should be in this third one an alteration in the form of that most characteristic organ of a dog, the mouth. But such is the fact. These dogs do not bite with the same sharp snap as the others; but in them all there is a disposition to hold on and to shake in pieces whatever they lay hold of. Their object, in fact, appears always to be the mangling and destruction of that on which their anger is directed, and though, in the performance of this, many of them are faithful, it is a faithfulness of ferocity. It is for this reason that they are chiefly employed as watch-dogs; and it is their bad qualities, not their good ones, which are turned to account by their masters. They are, in short, dogs which are wanted only in vicious and depraved states of society; and it does not reflect much credit upon civilised man that there should be no such dogs found among savage nations. If we could ascertain by what means the different breeds which form this section have been derived from the dogs which we know in wild nature, or whether they have been derived at all,

it would be a very curious inquiry, but, unfortunately, we have not sufficient data for such an investigation; but, though we are not acquainted with the means by which mankind has been enabled so to degrade the more generous and noble qualities of the dog, as they are found a great deal in these races, yet there is no reason to doubt that the degradation is the result of human interference. Still, it is a curious matter, that not only the form of the head, and the shortness of the muzzle, but that the whole structure and appearance of the animals, which, judging from what we see in nature, are artificial, should have been altered so as to suit this apparently impressed and unnatural habit. We have no means of unravelling the mystery; but really it is a curious matter, that, along with a cessation of swiftness in the chase, or play as a companion, there should have been imparted to those dogs a strength of body, and a shortness of muzzle, which are not possessed by any of the rest; and these qualities are accompanied by a corresponding expression in the eye and hair of the animals. In the larger kinds, both eye and hair express ferocity, while in the smaller ones the expression is that of indifference or stupidity; and both have the body much more thickly set, the chest wider, and the legs farther apart, than in those of either of the former divisions. There is also a distinctive character in the very covering. None of them have that smooth lengthened and curly hair which is so pretty in the smaller spaniels, and so graceful in the larger ones and the Newfoundland dogs; neither have they that smoothness and gloss which we observe in the terriers (with the exception of the Scotch one), which, of all dogs of the former divisions, perhaps make the nearest approach to the present division, though they far excel them in sagacity. The character of the head is especially worthy of notice. In every dog of the two former divisions, of what breed soever he may be, and whether pure or mongrel, there is a pleasing expression in that part; and even in those species, such as the greyhound, which are the least intelligent, there is always some speculation in the eye—something in the look of the animal, which speaks kindness and companionship; but a dog of this short-nosed species, though he follows his master, feeds at his expense, and fights desperately for or with him, in good cause or in bad, merely glares upon the observer, and has no speculation in his eyes. His services as a guardian or a warrior may procure him respect; but his own looks do not put in any thing like the same claim to kindness or society, which is solicited by a single glance from the other dogs. It is further to be remarked, that the dogs kept by the worthless and profligate part of mankind are almost invariably of this short-nosed kind.

The varieties of those short-nosed dogs are not nearly so numerous as those of either of the former divisions, but as they are dogs which are chiefly bred for sporting purposes, much attention has been paid to the breeds. They may be considered as forming three classes:—first, dogs which are wholly untractable and pugnacious, and therefore never used except as fighting dogs; secondly, dogs which still possessing much strength and ferocity, and not capable of much training and attachment, but which are used as watch dogs; and thirdly, dogs of smaller breed, which are too feeble for doing much mischief, and which may be reckoned the most useless perhaps of all the genus.

THE BULL-DOG. This dog in various breeds may be regarded as the fighting dog *par excellence*; and, as the satirist said of the captain—"His very look's an oath," so it may be said of the bull-dog—"his very look's a bite." This dog is low on the legs, and stands rather wide; his chest is deep and also broad; his shoulders and thighs are very strongly made; and the muscles are exceedingly developed, more so than perhaps in any other animal, not even excepting the lion. The head is broad, his nose short, and the under jaw projects beyond the upper, which gives him a very disagreeable and fierce aspect. The eyes of the bull-dog are very prominent and distant, and have a very peculiar suspicious-looking leer, which, with the distension of his nostrils, gives him also a contemptuous look; and from his teeth being always seen, he has the constant appearance of grinning while he is perfectly placid. This is the most unrelenting and ferocious of the canine tribe, and may be considered courageous beyond any other creature in the world; for he will attack any animal whatever be



The Bull-dog.

his magnitude. He is scarcely capable of any education, and is fitted for nothing else but combat and ferocity. The bull-dog takes his name from having been employed in former times in assaulting the bull, and is used for that purpose at the present day in those districts where this brutal amusement is still practised. The fury with which the bull-dog attacks all other animals, and the invincible obstinacy with which he maintains his hold, nothing can exceed. The bull-dog makes his attack always in front; and in assailing the bull, he attempts to seize him by the nose, the lip, the tongue, or the eye. If the dog succeeds in fastening, and the part is tough enough not to be torn off by the bite, the dog will not quit his hold, and cannot be shaken off by any effort of the animal, but will adhere though the other swing him round and round in the air. When they fight with each other, or with other dogs, they are equally desperate in their hold; and when they once fasten they will allow themselves to be bitten ever so severely by another dog, or beaten, and still give vent to their anger by tightening the hold which they got at first. There is nothing indeed which will loosen a staunch bull-dog, but that general means of truce to all canine hostilities, a copious effusion of cold water. This is a curious fact in the natural history of dogs, inasmuch

as it shows that there is some physiological relation between the fury of dogs when excited to a very high pitch and the dreadful malady of canine madness, or hydrophobia; for whether as displayed in the dog itself, or in those dreadful instances of human suffering which follow from the bite of a rabid animal, there is an indescribable horror of water, altogether independent of the difficulty of swallowing that or any other liquid. So remarkable is this that the very sight of water appears to shake the whole nervous system to pieces, and from the terrific expression of it the feeling itself must be dreadful.

If a bull-dog attempts to attack or to bite any part of an animal except the head or throat, he is considered as being of inferior breed, and not wholly a murderer in his disposition, which is the character that procures him the highest estimation among that description of persons who keep bull-dogs. Those dogs are not now so numerous, or held in such high estimation, as they were in former times; and we believe we may say, that the keeping of them for what is called "sport" is confined to the very lowest and least reputable characters, whatever may be their nominal rank in society. Formerly, however, the savage practice of baiting bulls publicly was very much in vogue; and it was then held as having no mean place among what were called "manly sports" in England, though they were in truth "beastly cruelties." In the reign of Henry II. bull-baiting was an amusement of the London populace. Nay, much more recently, Queen Mary entertained the French ambassadors two successive days with an exhibition of this kind in the year 1559. Queen Elizabeth, her sister, repeated it to the ambassadors from Denmark in 1586, and, what is more extraordinary, the former was herself among the spectators. Paul Hentzner, still later, describes the cruel diversion of the English people, to whom the baiting of bulls, bears, and badgers was familiar; and there is even reason to believe that the horse was sometimes publicly worried to death, to glut their savage appetites for a brutal spectacle. On all these and similar occasions, such as when a bull, jointly pursued by the dogs and their masters, was hunted down or bruised to death with clubs, the minstrels, a misereant crew, claimed the slaughtered animal as a perquisite. It is long since the worrying of bulls in London was prohibited, but the practice was widely extended; and the ring to which the bull was chained for the certainty of undergoing aggravated torment, is still extant in many towns and villages, where they are sometimes converted to use. It is in all probability, from the "bull ring" being the regular place of rendezvous for all sorts of savage sports, and not from the form of the enclosure used on such occasions, that the place where, for a time, the bull-dogs of the human race continued the "sport," by mauling one another, first obtained the name of the ring. These things have fortunately, however, had their day; and future ages will be astonished that, not many years ago, the practice of bull-baiting was defended in the British parliament as a means of improving the spirit of the people.

THE MASTIFF. This is one of the most powerful of the whole race of dogs, and, for the purposes to which he is applied, one of the most serviceable. His aspect is not quite so expressive of unmingled ferocity as that of the bull-dog; and when he is not aroused, there is a considerable expression of repose, and even of dignity, about him. Those who profess to be

most deeply learned in the pedigree and progressive history of dogs describe the mastiff as an original English breed; and we believe it is true that mastiffs were formerly much more numerous in England than they are at present, and that in those earlier times the breed was less contaminated by crosses, and the animals altogether of superior quality. It is understood that English mastiffs, as well as English bloodhounds, were known and esteemed in the time of the Romans, though it is perhaps not very easy to say what varieties were then meant, or how far they agree with or differ from those of the present time. There are certainly not so many mastiffs in the continental countries as there are in Britain; the watch-dogs there usually partake more of the character of the wolf-dog, or of the French martier.

As it is only in the character of a watcher that the mastiff is valuable, it is easy to see why the use of him in this country should have fallen off. When police regulations were much less attended to, the population thinly scattered, and the moral habits of the people, in matters of *meum* and *tuum*, rather lower, the services of the watch-dog were in general requisition; and both the strength and ferocity of the dog, and the loud alarm which he is capable of giving, were of great service, the one to check the depredator, and the other to arouse the inmates of the house. Though this dog, like the bull-dog, always attacks in front, and aims his attack in a deadly manner, yet he does not, like that animal, attack without warning given. The bull-dog, as a watcher, ought never to be kept in any other way than chained, because he bites without previously giving mouth, bites indiscriminately or capriciously and, even when he is successful in seizing one of a party, he gives no alarm to afford security against the others. The mastiff, by giving an alarm, always warns on the one hand, and calls attention on the other; and a thorough-bred mastiff, if not kept on the chain, will not bite unless something under his charge is attempted to be taken hold of by some one with whose person he is not familiar. If chained, he is far more ferocious, and flies indiscriminately at all strangers that come within his reach, while, if the animal is powerful, and the chain at all fragile, his violence is apt to tear it asunder. It seems, indeed, that this chaining up completely destroys the more valuable qualities of the mastiff, and inflames all his bad ones; for, when he is allowed his freedom, he does not show much ferocity, unless the circumstances are such that, according to his training, there is cause and justification for his rage. In extensive yards and manufactories, where a mastiff is duly fed and watered, and left to his range, it is rather pleasant to observe with what dignity, and in how business-like a manner, he does his duty. All the people employed about the work, and also those who come at the regular hours, and in the regular way of business, are quite unnoticed by him; but, if any one is prowling about, or comes when the people about the place are all at rest, the mastiff instantly has an eye upon him, watches his motions with the most scrupulous attention, barks on the least offer of interference with anything under his charge, and attacks whenever interference is actually made. There are many instances, too, in which this dog has taken prisoners, and kept them, without doing them any injury, compelling them to stand fast, without advancing or retreating, under dread of the severest penalty. Nor

have there been wanting instances in which a dog of this kind has thrown a refractory intruder on his back, and held him there uninjured, though in no very enviable situation, till the return of day, and the arrival of those for whom he kept watch. It is also worth while to observe a really good dog of this kind going his rounds over extensive premises. One would almost imagine that he has got a complete catalogue of the property, together with plans of all the holes and hiding places, for he leaves not a suspicious spot unexamined; and he does it all peaceably, if all is right, and then returns good humouredly to his watch-house.

The mastiff has no trick or play about him, very little disposition to hunt any animal, and it does not appear that his sense of smelling is at all acute. His character is too dignified, and his deportment too grave, for these matters, but still he has a wonderful aptitude in acquiring a knowledge of those duties for the performance of which his nature more immediately fits him; and when he has acquired this knowledge, no servant can be more faithful, or, generally speaking, more quiet and orderly in the performance of them. As we have said, the period of especial necessity for the mastiff, except in particular situations, has gone by, but still there is something respectable in the memory of this animal, which makes one almost regret that the pure race have been, in many cases where watch-dogs are still used, supplanted by mongrels. There is one circumstance in the character of modern depredators, as compared with those of former times, which has rendered watch-dogs of much less value than they were then. The depredators of the olden time came by force, and therefore they could be met and repelled by force; but the modern ones proceed by craft, and the art of silencing a watch-dog is, we believe, part of the regular system of education among our midnight plunderers. In consequence of this, the dog merely serves to alarm the timid, while against those who are bent upon mischief he is of little or no use.

THE BAN-DOG. This appears to have been the old name of all watch-dogs in England which were not of the true mastiff breed. The name is evidently a corruption of "*baying-dog*," that is, a dog very prone to give tongue—one whose bark was more formidable than his bite. Such dogs were of course mongrels, and differed in their dispositions and qualities according as they were more allied to one race or to another. Of such dogs no general description can be given, nor is any necessary.

THE CUBAN MASTIFF. This breed is very common in the island from which the trivial name is derived, and there it answers the purposes both of a mastiff and a bull-dog, being used for watching, and also in bull fights. These dogs are represented as being very faithful, and at the same time very courageous and staunch; they are smaller in size, and somewhat less dignified in expression than the true mastiff, but they have the broad head, the produced upper lip, and the pendent ears. Their bodies are about a mean in size between the mastiff and the bull-dog, and they are rather more muscular than the first of these, and less so than the second. Their covering is very short and close, but, as is the case with all dogs in a state of complete domestication, their colours are very various.

There are many breeds of what may be called useless dogs belonging to the short-nosed division, of which it will be quite enough to mention a few of the

names; and, indeed, they may all be regarded as in some way or other varieties of the *pug-dog*, which is a cowardly little animal, and at the same time snappish, and not susceptible of much education, or much attachment even to those who make a pet of it.



Cuban Mastiff.

The enumeration which we have given includes at least as full a view of the leading varieties of the dog as is necessary for the purposes of general knowledge, that is, for those who are neither professional zoologists nor dog-fanciers, and, of course, the technical information which they require would be useless to the public. We shall, therefore, close this article by one or two remarks on the dreadful malady to which this faithful, and, in its own place, valuable race of animals, is sometimes subject, and which, in the bitterness of their own agony, they sometimes most unhappily impart to human beings. This is the malady usually designated as *canine madness*, from its affecting dogs more readily than any other animals; and it is also called *hydrophobia*, because a dread of water is usually, though not invariably, one of its symptoms. But neither of those names is exactly expressive of the nature and characters of this dreadful malady—a malady which is more terrible than any other casualty to which human nature is subject, and which, we may add, is generally or invariably communicated by dogs which are altogether useless to their keepers, and very often nuisances to every one else. The most usual symptoms of this malady are said to be dulness, loss of appetite, and, in particular, a departure from the animal's ordinary habits. If a stick, held out by a person with whom it is familiar, excites resentment, this is reputed an infallible criterion. But the dog still continues tractable, and the persons generally around it are the least in danger of attack. Its voice next becomes more of a continued howl, with the head elevated in the air; great anxiety appears; it labours under apparent suffering, and testifies the strongest impatience of controul. At length it eagerly hurries from the house to which it has always been attached—it bites every animal in the way—its pursuit is incessant of all except mankind, for they are more rarely the objects of injury; and, when worn out with wandering, it will sometimes return. If escaping intentional destruction, the dog seldom survives the fourth or fifth day, refusing all food, and dying raging mad. It is a lamentable fact, that a mortal malady, known by the name of hydrophobia, may be imparted

by the bite of a dog indisputably rabid; but this distemper does not invariably ensue; neither can it be correctly designated the dread of water, for some dogs lap that fluid readily, from the fever affecting them, though they are unable to swallow it. Instant excision of the wounded part is always considered prudent, where it may be safely performed; and of late, excessive bleeding, such as repeatedly deprives the patient of sense and motion, seems to have been practised with success. More recently, this and some other spasmodic diseases, which are generally found to be incurable by any of the ordinary modes of treatment, have been treated by inoculation with hydrocyanic (prussic) acid, wourali poison, and some other of those substances or preparations which are most immediately fatal to life. The object is to produce a complete suspension of all the functions of the system—a sort of temporary death, as it were; and then, if the patient can be resuscitated from this temporary death, the disease is found to have left him. This is a desperate means of cure, and may be expected to be in most cases as bad as the disease, in so far as the life of the patient is concerned; but, even if the application is followed by death, the quantity of suffering is very much abridged by it; and as there is a ray of hope, though a very faint one, the application is justifiable in extreme cases, but in such cases only. The rationale of the application appears to be this:—All spasmodic diseases, or diseases which affect the functions of life rather than any part of the organisation, completely cease when life is extinct, without continuing in the form of putridity in the dead subject, as is the case with diseases of the organisation. Hence, if we can cause the life utterly and completely to cease, even for an instant, the disease is destroyed; and as the life is intimately connected with the organisation, while the disease is not, there is, as it were, a smouldering ember of the one, which lingers for a little after the other is gone; and if the proper stimuli can be applied to the organisation, so as to make it re-act and the life to return, it returns altogether freed from the disease. How long this power of re-action may continue, is a very nice and delicate, and must vary with the circumstances of each particular case. But the subject is one of the deepest interest, and eminently deserving of the most minute, careful, and scientific investigation by those whose profession it is to watch over the health of themselves and their fellow-men. It is of much too abstruse and delicate a nature for popular discussion, and even in the medical world it is new, and safe only in the hands of the most cautious and skilful.

DOG POISON is the *Æthusa cynapium* or fool's-parsley of Linnæus, a common British weed.

DOG'S-BANE is the *Apocynum androsæmifolium* of Linnæus; a flower-border plant of easy culture. The *Aconitum cynoctonum* of Reichenbach is also called dog's-bane.

DOG'S-TAIL GRASS is the *Cynosurus cristatus* of botanists, and a valuable agricultural plant, as forming a chief part of the herbage on upland meadows and pastures. It is the *Hendon Bent*, so much prized in the London hay-markets. This grass is always chosen as part of the mixture of seeds for laying down permanent meadows or pasture land.

DOG'S-TOOTH VIOLET is the *Erythronium dens Canis* of Linnæus, a beautiful tuberous-rooted perennial herb, belonging to *Hexandria Monogynia*,

and to the natural order *Liliaceæ*. See ERYTHRONIUM.

DOG-WOOD is the *Cornus Suecica* of Linnæus.

DOLICHOPIDÆ. A family of dipterous insects belonging to the section *Tanystoma* of Latreille, comprising an extensive group of flies, having the body generally compressed, the head triangular and slightly produced into a muzzle in front, the abdomen curved downwards at the extremity, and the legs very long and furnished with numerous small spines; the antennæ are short and composed of three joints with an articulated bristle; the wings have only one or two discoidal cells, the nervures nearly resembling those of the common fly.

These insects, which are generally found in damp situations, seldom exceed in size the domestic fly, have the body highly ornamented with green and other metallic tints, and in many species various remarkable sexual and other peculiarities are to be observed which are not found in other dipterous insects. They reside upon the leaves of plants, where their agility and brilliant colours render them conspicuous; others are to be seen running along the margins of streams; they seldom are observed extracting the honey from flowers, but rather sip the dew from the leaves. They walk sideways with as much facility as in a straight line. M. Macquart has observed one of them which had seized the larva of one of the small cicadæ, the body of which was half hidden within the large lips between which it was introduced, the sucker of the mouth being at the same time employed in extracting its fluids. According to De Geer, the larva of one of the species resides under ground, where the pupa is transformed.

There are numerous generic and subgeneric divisions established in this group, founded upon structural characters, but which it would be tedious in a work like the present to detail. The typical genus is *Dolichopus* of Fabricius, of which there are thirty British species, including the *Musca nobilitatis* of Linnæus. The student should consult Mr. Haliday's Memoir, published in the Zoological Journal, No. 19, and that published in a late number of the German periodical, the *Isis*, in which numerous new species are described.

DOLICHOS (Linnæus) is a genus of annual and perennial climbing plants, found in every quarter of the world. Class and order *Diadelphia Decandria*, and natural order *Leguminosæ*. Generic character: calyx bracteate, bell-shaped, five-toothed, two upper teeth united; standard spreading, furrowed at the base; keel angular, incurved, and obtuse; style flattened, bearded above; pod compressed with contractions between the seed-cells. These plants are easy of culture, growing in any kind of light soil, and may be propagated by cuttings: the annual sorts by seeds. A great many new genera have been separated from this.

DOLOMEDES (Latreille). A genus of erratic spiders, having the eyes arranged in a quadrilateral position, but somewhat broader than long, and in three lines, the anterior of which has four eyes, and the two posterior lines two eyes each, the hinder pair being slightly elevated on footstalks; the second pair of legs is as long as the first; the lip is short and square. These spiders do not construct a web, but chase and run after their prey in the same manner as the *Saltici*, a very active group, the species of which are constantly to be observed on walls, creeping very

cautiously along, and jumping from considerable distances upon flies and other insects. The *Dolomedes*, however, at the period of laying their eggs, form a little web upon the plants, within which a cocoon-like mass may be observed which contains the eggs. These they guard with great caution, as well as the young as soon as they are hatched. Moreover, when disturbed, they run off with their egg bag. The type of the genus is the handsome *Aranca marginata*, found on the margins of streams, and figured in Kirby and Spence's Introduction to Entomology, vol. ii. pl. 5, fig. 4.

DOMBEYA (Cavanilles). A genus of ornamental trees, indigenous to the islands of Bourbon and Mauritius. Linnæan class and order, *Monadelphica Dodecandria*, and natural order *Byttneriaceæ*. Generic character: calyx five-parted; stamens numerous, growing out of the base of the tube. Ligulæ long, and linear between every three stamens; style filiform, five-cleft at top, stigmas reflexed: capsules five, one or many-seeded, two-valved, united; seeds oblong. These plants are grown in loam and moor-earth, and are propagated by cuttings in sand in a moist heat.

DONACIA (Fabricius). A genus of coleopterous insects belonging to the section *Tetramera* and family *Crioceridæ*, having the body oblong and depressed, the antennæ moderately long and of equal thickness throughout, the posterior thighs often thickened and toothed beneath, the jaws robust with two or three acute terminal teeth, and the terminal joint of the tarsi received between the lobes of the third joint. These insects, of which there are upwards of twenty British species, are of elegant form, and generally ornamented with brilliant colours of a metallic kind. They are also furnished with a silky down on the under surface of the body, which is of service to them by preventing them from sinking when they fall into the water, upon the plants growing in which they reside often in considerable numbers. In the twelfth number of the Magazine of Natural History is contained an account of the discovery of the egg-shaped transparent brown cases of one of the species containing the perfect beetle, on the stems of *Arundo phragmites*, close to the root, and immersed in the water or mud. It is not, however, stated at what period of the insect's existence these cases (which are described as the winter quarters of the *Donacia*) were constructed. It might indeed be inferred from the perfect beetles being found in them that they were constructed by the beetles for their abode. But that they were intended neither for permanent nor occasional abodes is evident from the external habits of the insects. They might perhaps indeed be supposed to be constructed by the beetles for their winter abodes, but, as Messrs. Kirby and Spence observe, "it does not appear that any perfect insect has the faculty of fabricating for itself a winter abode similar to those formed of silk, &c. by some larvæ. Schmid indeed has mentioned finding *Rhagium mordax* and *Inquisitor* (beetles nearly related to *Donacia*) in such abodes, constructed, as he thought, of the inner bark of trees; but these, Illiger has suggested, were more probably the deserted dwellings of lepidopterous larvæ, of which the beetles in question had taken possession." The circumstance of the cases of the *Donacia* being found at the root of the plants immersed in the water is sufficient to prove that they were not formed by the beetle, since it cannot be

supposed that an insect living above the surface of the water and constantly on the wing would select a spot for its winter abode beneath the surface of the water. It only therefore remains to regard these cases as the production of the larvæ, within which the perfect beetles are transformed at an early period, so as to take advantage of the first fine days of spring; and indeed Messrs. Kirby and Spence expressly state "that amongst the larvæ which enclose themselves in silken cocoons are those of the brilliant beetles frequenting aquatic plants, constituting the genus *Donacia* (Fabricius), and that the case of *D. fasciata* is fastened by one side to the roots or surculi of *Typha latifolia*;" and the following observations from the same authors will perhaps be regarded as sufficient authority for our regarding the larvæ as the architects of the cells, and at the same time for enabling us to account for the discovery of the perfect beetles in the winter:—"Insects of the beetle tribe, especially such as undergo their metamorphosis under ground, in the trunks of trees, &c., are often a considerable time after quitting the puparium before their organs acquire the requisite hardness to enable them to make their way to the surface; thus the newly disclosed imago of *Cetonia aurata* remains a fortnight under the earth; and that of *Lucanus cervus*, according to Roesil, not less than three weeks."

One of the handsomest, and, at the same time, most abundant species, is the *D. Proteus*, so named from the endless variety of colours which it assumes, varying from a rich red to copper, purple, blue, green, bronze, &c. It is to be met with upon plants in ditches in almost every situation, and is about one third of an inch long. There are about twenty other British species.

DONAX is the specific name of the arundo-donax of Withering, a reed common in the south of Europe.

DORCUS (Macleay). A genus of stag-beetles (*Lucanidæ*), distinguished by having the jaws but of moderate size, the antennæ terminated by a four-jointed sub-perfoliated club, the head very broad, and the upper lip distinct. The only British species is the small stag-beetle (*Lucanus parallelopipedus*, Linnæus), which is about an inch long, a little more or less, and of a black colour. It is found in decaying trees in various parts of the country.

DORIPPE (Fabricius). A curious genus of crustaceous animals belonging to the *Brachyurous decapods*, or crabs, and to the section *Notopoda* of Latreille, so named in consequence of two or four of the posterior legs being rudimental and dorsal. The shell is of an ovoid form, truncate behind, the claws are very small, and the four hind legs short and slender. There are three Mediterranean species of crabs belonging to this genus, of which the *Cancer lanatus* of Linnæus is the type.

DORITIS, Fabricius; (PARNASSIUS, Latreille). A handsome genus of butterflies (*Lepidoptera diurna*), differing from the true genus *Papilio*, *Machaon*, &c., by having the palpi evident, in front of the head, and composed of three distinct joints. The club of the antennæ is short. The females have a kind of corneous pouch at the extremity of the abdomen. The caterpillars, like those of the true papilionæ, have the neck furnished with a retractile fleshy appendage, but they differ from the majority of butterfly-caterpillars in constructing a cocoon, in which they are transformed into chrysalides. The species, of which there are but few in number, inhabit the mountainous dis-

tricts of Europe, being found upon the Alps, &c. The type is the *Papilio Apollo* of Linnæus, which, like most of the species, is of a white colour, with four eye-like spots with red and black circles.

DORONICUM (Linnæus). A genus of herbs, chiefly European, belonging to *Syngenesia superflua*, and to the natural order *Compositæ*. These plants grow freely in any garden soil, and are easily increased by division: they flower early in the spring. Leopard's Bane is their English name.

DORSTENIA (Linnæus). A genus of plants, remarkable for their manner of flowering. Linnæan class and order *Tetrandria Monogynia*, and natural order *Urticææ*. Generic character: receptacle fleshy, somewhat concave, quadrangular or roundish, bearing both male and female flowers. Perianthe none; stamens mixed with styles; anthers two-celled; styles laterally bifid; seeds naked, in cavities of receptacle. This plant is cultivated in the stove more as a vegetable curiosity than for its beauty, for neither its flower or foliage can be called handsome. It is easily increased by dividing the root or by seed.

DORTHESIA (Bosc). A genus of small but curious insects, nearly allied to the *Coccidæ*, which see. The species are found upon plants, the males are adorned with a long and pencil-like tail, and the females are covered with waxen scales of various forms, which give them a very remarkable appearance. They are of small size.

DORY, DORÉE, or "JOHN DORY,"—*Zeus faber*. A celebrated species of fish belonging to the spinous finned order, the mackerel family, and the genus *Zeus*; but because it has been in all ages a fish of some celebrity, we have deemed it necessary to give a short account of it under its common English name. "John Dory," its usual name among the fishermen, has no connexion with the name John any more than *anchovy* has with the name Anne, though every one must be aware of the punning allusion to eating dory with anchovy sauce, as being "the legitimate marriage of John Dory and Anne Chovy."

This fish was known to the Greeks and to the Romans, and the former have left evidence of the estimation in which they held it, in having named it after Zeus or Jupiter, the captain-general of the gods. Nor are we without evidence of the esteem in which this fish was held by the monastic epicures of the middle ages, for it was one of those fishes which they coupled, by means of legendary fables, with the sacred name of the founder of Christianity. Whenever we find any fish or other animal thus connected, we may always make certain that such fish or animal is a *bonne bouche*, for the very same reason that the term *Lachrymæ Christi* has been applied to the most luscious production of the vine. Thus, though those fables are, to say the best of them, specially absurd in their original application, they all afford some useful lesson in the way of good eating, and there is no reason why we should throw away this because it is connected with an absurd fable. The ocellated spots, which are so conspicuous in the dory, are like those less conspicuous ones on the haddock, the marks left by the finger and thumb of St. Peter, as he held the fish in the one hand, and took the tribute money out of its mouth with the other. It does not appear that the inventors of this fable, who no doubt had a view to the ample supply of these half-canonised fishes, had much regard to the apostle's character for cleanness; for, if they had reflected a little, they must have per-

ceived how shockingly dirty the thumb and finger must have been in order to stain fishes with indelible black spots down to perhaps the thousandth generation, and as much longer as this species may tenant the sea. As the one piece of tribute money could not well be taken out of the mouths of two fishes, neither of which is, we believe, to be found in any of the salt lakes of Judea, which are the only seas alluded to in the Gospels, therefore the dory gets another chance of having received these spots as a mark of such saintship as credulity might suppose to belong to a fish. It is said that St. Christopher, while wading through an arm of the sea with our Saviour on his back, caught a dory, and impressed the spots with his thumb and finger, which is of course as ridiculous as the former story, and meant to answer exactly the same purpose. Our common name John Dory is clearly nothing more than a corrupt pronunciation of the French term for the colour of the lighter parts of the fish, which is yellow with metallic reflections, when the fish is alive, and therefore very properly styled *jaune dorée*, or gold and yellow.

We shall avail ourselves of Mr. Yarrell's very excellent and accurate description of this fish in his work on the history of British fishes; and we do this the more readily, that it gives us an opportunity of saying that this work is one of the few which tend to confer the highest honour upon the author, and render the greatest assistance to the public in the real knowledge of the subject. "The body of the dory," says Mr. Yarrell, "is oval, very much compressed; the head large; the mouth capable of great protrusion, so much so, that from the point of the lower jaw, when extended, to the posterior angle of the operculum is as long as from that angle to the base of the caudal rays. The length of the head when the mouth is not projected is nearly as long as the body is in depth. The mouth large; the teeth small and numerous, placed in a single row in each jaw, and curving inwards; the eyes large, situated laterally and high up on the head; irides yellow; a spine behind and over each orbit, about half way between the eye and the first ray of the spinous portion of the dorsal fin; the spines of the first dorsal fin very long, the longest half as long as the body is deep; the membrane between the spines ending in a filament three times as long as the rays. The base of the second dorsal fin about as long as that of the first; the rays flexible, and only half as high as those of the first; the pectoral fin small and short, ending on a line with the anterior edge of the dark spot on the side; the ventrals very long and slender; arising in advance of the pectorals, the rays reaching as far back as the first flexible ray of the anal; the first spinous ray of the anal fin is on a line with the posterior edge of the dark spot, and with the sixth spinous ray of the dorsal; the flexible portion commences and ends nearly on the same planes as the flexible dorsal. The tail is narrow, long, and slender; the lateral line, advancing at first straight, afterwards rises in an elevated arch over the dark spot, which is placed at about the diameter of its own breadth behind the posterior angle of the operculum. A row of spiny scales pointing backwards are ranged along the base of the dorsal and anal fins on both sides.

"The prevailing colour of the body is an olive brown, tinged with yellow, and reflecting in different lights, blue, gold, and white; when the living fish, just taken from the net, is held in the hand, varying

tints of these different colours pass in rapid succession over the surface of the body. The membranes of the flexible portions of the fins are light brown; those of the spinous portions are much darker.

"A large portion of the dorées supplied to the London fish market is brought by land carriage from Plymouth and some other parts of the Devonshire coast. Being a ground fish, they are little or none the worse for keeping till the second or third day. Montagu, disliking the toughness of a fresh-caught dory, says they are most palatable after keeping two days. Fish for the supply of the London market was not brought by land carriage until the year 1761. Steam boats seem likely to effect another change. In the summer of 1834, a cargo of salmon from Scotland was deposited in the London market within forty hours."

The dory is not a very common fish upon the British shores; and its appearance is apparently capricious as well as local. It belongs to warmer seas, and therefore it is never found on the north and north east coasts of the island, and very rarely on the east, and not, we believe, further to the northward than the coast of Norfolk, upon which it may be considered more in the light of a stray than of a regular visitant. On the south-west coast it is much more common, being sometimes abundant on the shores of Cornwall and Devon, though rarely further to the eastward. In Ireland it comes round both ends of the island, as far as Waterford on the south, and the coast of Antrim on the north. From this we may conclude that it should be found all along the west coast of that island. There are, however, some difficulties attending both the places and seasons of resort of those wandering fishes to which the dory belongs. Though classed with the mackerel family, the greater number of which are surface fishes, and migratory in shoals with considerable regularity of season, the dory is described by Mr. Yarrell, and all those who have the best opportunities of ascertaining its habits, as being "a ground fish." From the structure of the fish, the habits of the rest of the family, and the situations in which this particular member of it is found, we should not be inclined to give it so deep a situation in the waters as that of an absolute ground fish; though it certainly does inhabit lower down than most of the others. According to Mr. Couch, it follows the shoals of pilchards, and also feeds on the cuttle, which is not, any more than the pilchard, an inhabitant of the sea bottom; and the same authority, and we believe he will not be questioned as to the accuracy of his facts, mentions that the dory is seen floating along with the current, which again is not the habit of a ground fish. The produced filaments, the singular shape, and the means of entanglement which the whole external structure of the dory presents, clearly point it out as a fish which has not much command of itself in the water, and therefore as one which must be to a very great extent at the mercy of every current in which it happens to be taken. But at the same time the structure of the fish corroborates the facts mentioned by Mr. Couch, as to the floating of this fish being nearer the surface of the water than the bottom. We are not acquainted with any habitual ground fish with a compressed body, at least with the compressed body so placed as that its motion in the water is, with the most extensive dimension, vertical. All the flat fish, which are ascertained to be bottom

way, and there is not one of them furnished with fins bearing the least analogy to those of the dory. Their organs of motion are all constructed for acting most effectively either upwards or downwards, and they are in general short, and continuous round the extremities in the flattened direction. The organs of the dory are, on the other hand, chiefly constructed for lateral motion, without any powers of ascent and descent so strikingly indicated as we find them in the flat fishes. If, therefore, the authorities are correct in stating that the dory is a ground fish, it forms a curious anomaly to the generality of fishes which have that habit, and may be regarded as being as great a curiosity in natural history as it is in the annals of superstition and gastronomy. It is well known that Quin, who was equally remarkable for his comic powers in the theatre, and his epicurean propensities at the table, contributed mainly to bring this fish into that public notice which it has since enjoyed; and as the circumstances of this case are calculated to throw some light both on the fish and the man, we shall venture to give an anecdote not, we believe, generally known, which Mr. Yarrell quotes from a manuscript of the amiable and indefatigable Colonel Montagu. "It is now," says the colonel, "about sixty years (at present, 1835, it is nearer eighty) since the celebrated Mr. Quin, of epicurean notoriety, first discovered the real merit of the dorée; and, we believe, from him originated the familiar, and we may say national, epithet of 'John Dory,' as a special mark of his esteem for this fish; a name by which it is usually known in some parts, especially at Bath, where Quin's celebrity as the prince of epicures was well known, and where his palate finished its voluptuous career. Notwithstanding the numerous anecdotes recorded of this gentleman, as famous for his love of good living as for his excellence as a comedian, and who shone equally as a *bon vivant* as in the character of Falstaff, we may be allowed to record one more in honour of both the person who brought the dorée into such high estimation and of the fish itself. An ancestor of ours, a Mr. Hedges, was an intimate friend of Quin, and was induced by him to take a journey from Bath to Plymouth, on purpose to eat 'John Dory' in the highest perfection, not only from procuring it fresh, but with the additional advantage of having it boiled in sea water, a matter of very great importance to the palate of Quin. As this journey was purposely taken to feast on fish, their stay at Plymouth was not intended to exceed a week, by which time they expected to have their skins full of dorée; but that no opportunity might be lost, Quin left strict charge with the host at Ivybridge to procure some of the finest dorée he could get for his dinner on his return, fixing the day. Whether our celebrated epicure was disappointed in his expectations at Plymouth is not recollected; but that he might have the provided fish at Ivybridge in the highest perfection, and remarking that the place was too remote from the coast to obtain sea water for dressing the dorées anticipated, he ordered a cask of sea water to be tied behind his carriage. Unfortunately the weather had been stormy, and no fish of note could be procured. Every apology was made by the host, who assured him that an excellent dinner was provided, which, he had no doubt, would be to his taste, but no fish. The disappointment, however, was too great to be borne with patience; after having made a water-cart of his carriage, and the appetite having been set for 'John

Dory' boiled in sea water, no excuse, no apology would satisfy Quin, and he declared he would not eat in his house, but, like a ship in distress, threw his water cask overboard, and pursued his journey not a little sulky, till some fortunate stroke of wit or some palatable viand roused him to good humour. This western tour of Quin's did not appear to have given him much satisfaction, as may readily be imagined by his reply to a friend on his return to Bath. Being asked if he did not think Devonshire a sweet county, 'Sir,' said Quin, 'I found nothing sweet in Devonshire but the vinegar.' Such is a specimen of Quin's *Ichthyomania*, as left on record by Colonel Montagu, and with it we shall close our short notice of the dory, leaving the reader to judge whether the history of the fish or the actor be the more curious subject of the two.

DORYANTHES (Correa de Serra). A large herbaceous plant, a native of New South Wales. Class and order: *Hexandria Monogynia*, and natural order *Amaryllidæ*. Generic character: flowers on a braeteated fascicle; corolla funnel-shaped, six-cleft; stamens inserted into the base of the segments; filaments awl-shaped; anthers like fingers, erect, four-sided; style three-furrowed; stigma three-sided; capsule three-celled, three-valved; seeds disposed in pairs. This gigantic herb bears cream-coloured flowers, and does very well in a green-house. It sometimes produces suckers, by which it may be increased.

DORYLUS (Fabricius). A genus of singular hymenopterous insects, of which the males only have hitherto been observed, belonging to the family of *Mutillidæ*. The body is long, and the abdomen knotted at the base; the antennæ are short and slender, and inserted near the mouth, the various parts of which are very small; the legs are very short, with the thighs flattened. There are at least two species inhabiting India and the Cape of Good Hope. The writer of this account has been informed by the celebrated African traveller, W. Burchell, Esq., that their habits are nocturnal. The genus is represented in South America by that of *Labidus*, which differs chiefly in the structure of the mouth, and smaller size. The type of the *Dorylus* is the *Mutilla helvola* of Linnæus.

DOVE'S FOOT is the *Geranium molle* of Linnæus, a common British plant.

DRABA (Linnæus). An extensive genus of small herbaecous annuals, biennials, and perennials, natives of the coldest and most rocky regions of Asia, Europe, and America. They are tetradynamous, and belong to *Cruciferæ*. Several species of this family are early flowerers, which gain them admittance into the flower-gardens, and are particularly useful for rock-work.

DRACÆNA (Linnæus). Tropical trees and shrubs of a very unusual colour; hence the name, as their juice is said to furnish or resemble the drug called dragon's blood. The flowers are hexandrious, and the plant belongs to the order *Asphodeleæ*. Generic character: corolla spreading, regular, six-parted, deciduous. Stamens inserted in the base of the corolla; filaments membranous at the base, thick in the middle, and awl-shaped at the apex. Style rather angular; stigma three-cleft; berry six-furrowed, three-celled, cells mostly one-seeded. These plants give variety to the stove collection by reason of the deep purple hue of the foliage. "Large cuttings root

freely by being stuck in the bark-bed in a brisk heat." —*Sweet*.

DRACOCEPHALUM (Linnæus). A genus of odoriferous annual and perennial herbs, mostly found in the north of Asia, Europe, and America. Class and order, *Didynamia Gymnospermia*, and natural order *Labiataæ*. The best known and most generally cultivated species of this genus is the *D. Canariense*, the balm of Gilead, met with in every greenhouse, not because of its beauty either of flower or foliage, but entirely for its pleasant and powerful scent. It may be propagated either by cuttings, seeds, or division of the roots.

DRACONTIUM (Linnæus). A genus of curious creeping plants, natives of India, belonging to the seventh class of Linnæus, and to the natural order *Aroideæ*. Generic character: spatha of one leaf; spadix cylindrieal, to which the flowers are attached; perianthe cut into five or six petal-like scales; stamens inserted into the bases of the scales; filaments linear; anthers oblong, two-celled, opening by a pore at the top; style elongated, three-sided; berry three-celled, three-seeded. These are plants of no beauty, but curious in form. They grow in any light soil, and are increased by division.

DRACOPHYLLUM (R. Brown). A genus of handsome shrubs, natives of New Holland. Linnæan class and order, *Pentandria Monogynia*, and natural order *Epacrideæ*. Generic character: calyx five-parted; corolla tubular; limb beardless, five-cleft; stamens below the germen, or fixed to the base of the corolla; anthers fixed by the back; style simple; stigma three-lobed; five scales below the germen; capsule with a central placenta. These plants grow well in the common compost of moor-earth, sand and loam, and are propagated by cuttings.

DRAGON-FLY—Adder-bolt, or Horse-stinger. The ordinary names by which numerous large species of neuropterous insects, composing the families *Libellulidæ* and *Agrionidæ*, are distinguished. Wherefore such names as these should have been bestowed upon the most harmless of insects we know not; by the French, the superior gallantry of whom is exhibited even in the naming of an insect, they are termed *Demoiselles*, from their elegant form and the delicacy of their wings, which are transparent as gauze, often ornamented with coloured spots, and exhibit, when viewed in different lights, all the iridescent tints of the rainbow.

The structural characters of this group of insects will of course be given under the systematic name, we therefore proceed to their natural history.

Nothing can be more beautiful than to watch these brilliant insects on a fine summer's day skimming over some standing water, and darting backwards and forwards. The object of this continual flight is the discovery and capture of small flies and other insects, which constitute their food. Like the swallows, which are their analogues, they have a mouth capable of much distension, and the long abdomen acting as a rudder enables them to effect the most perfect movements in the air, so that an insect when observed has but little chance of escape. Flies, moths, and even butterflies are seized, and the *Libellula* may often be seen flying about with a large insect in its mouth, more than equal in size to its own head. It is owing to the numbers of insects frequenting such situations, as well as to the circumstance that the *Libellula* are produced from aquatic larvæ, that they are so

commonly seen about water. Often two of these insects may be observed flying together in a line, the neck of the hinder one, which is the female, being held by the extremity of the tail of the one in front, or the male.

Shortly after this has been seen, in walking on the banks of water, a rustling sound may be heard amongst the aquatic plants growing thickly together, and which is soon discovered to be caused by the wings of the female touching the stems of these plants whilst in the act of depositing her eggs on the water. During this act the tail is beat upon the surface of the water with rapid succession, until the eggs form a mass somewhat like a bunch of grapes.

The larvæ are soon hatched, and the insect retains its aquatic habits until the moment when it assumes the winged state. So long as they remain in the water, they change their form but slightly, but retain nearly that which they exhibit at their first exclusion from the egg. Old Izaak Walton tells us a marvellous story about a green caterpillar or worm, as big as a peascod, "which I have seen, and may therefore affirm it to be true," found upon a privet hedge, and which was kept in a box, and fed with privet, "but by some neglect in the keeper of it, it then died, and did not turn to a fly; but, if it had lived, it had doubtless turned to one of those flies that some call flies of prey, which those that walk by the rivers may in summer see fasten on smaller flies, and I think make them their food." This green caterpillar was, however, doubtless that of the privet hawk moth (*Sphinx ligustre*); and as this fine moth is but seldom seen on the wing, it is not perhaps surprising that the old fisherman should have supposed that the large day-feeding caterpillar should turn to the comparatively large day-flying dragon-fly.

The larvæ of the dragon-flies have the body comparatively short and thick compared to that of the perfect insect; they are provided with six moderately long scaly legs. They shed their skin, and on becoming pupæ they are equally active as before, and have four small scaly pieces, which are the cases in which the large future wings are concealed. In their aquatic state these insects have a remarkable apparatus attached to the head, enabling them to seize their prey, which consists of other aquatic insects. It is so admirably described by Messrs. Kirby and Spence, that we give their account, with some omissions, rather than attempt its description afresh:—"One of the most remarkable prehensile instruments, in which the art and skill of a Divine mechanic are singularly conspicuous, and which appears to be without a parallel in the insect world, may be seen in the *under lip* of the various species of dragon fly. In other larvæ this part is usually small and inconspicuous, and serves merely for retaining the food and assisting in its deglutition, but in these it is by far the largest organ of the mouth, which, when closed, it entirely conceals, and it not only retains, but actually seizes the animal's prey by means of a very singular pair of jaws with which it is furnished. Conceive your under lip (to have recourse, as Reaumur did, on another occasion, to such a comparison) to be horny instead of fleshy, and to be elongated perpendicularly downwards, so as to wrap over your chin, and extend to its bottom, that this elongation is then expanded into a triangular convex plate attached to it by a joint, so as to bend upwards again, and fold over the face as high as the nose, concealing not only the chin and

the first-mentioned elongation, but the mouth and part of the cheeks; conceive, moreover, that to the end of this last-mentioned plate are fixed two other convex ones so broad as to cover the whole nose and temples, that those can open at pleasure transversely, like a pair of jaws, so as to expose the nose and mouth, and that their inner edges, where they meet, are cut into numerous sharp teeth and spines, or armed with one or more long and sharp claws, you will then have as accurate an idea as my powers of description can give of the strange conformation of the under lip in the larvæ of the tribes of *Libellulina*, which conceals the mouth and face precisely as I have supposed a similar construction of your lip would do yours. You will probably admit that your own visage would present an appearance not very engaging while concealed by such a mask; but it would strike still more awe into the spectators, were they to see you first open the two upper jaw-like plates, which would project from your temples like the blinders of a horse; and next, having, by means of the joint at your chin, let down the whole apparatus*, and uncovered your face, employ them in seizing any food that presented itself, and conveying it to your mouth. When the insects would make use of it, they unfold it like an arm, catch the prey at which they aim by means of the mandibuliform plates, and then partly re-fold it, so as to hold the prey to the mouth in a convenient position for the operation of the two pairs of jaws with which they are provided. This conformation so exactly resembles a mask, that, if entomologists ever went to masquerades, they could not more effectually relieve the insipidity of such amusements, and attract the attention of the *demoiselles*, than by appearing at the supper-table with a mask of this construction, and serving themselves by its assistance. It would be difficult, to be sure, by mechanism, to supply the place of the muscles with which the insect is amply provided, but Merlin, or his successor, has surmounted greater obstacles. You will admire the wisdom of this admirable contrivance, when you reflect that these larvæ are not fitted to pursue their prey with rapidity like most predaceous animals, but



A, the pupa with its mask extended. B, the same with the mask closed, and discharging a current of water.

that they steal upon them, as De Geer observes, as a cat does upon a bird, very slowly, and as if they counted their steps, and then, by a sudden evolution

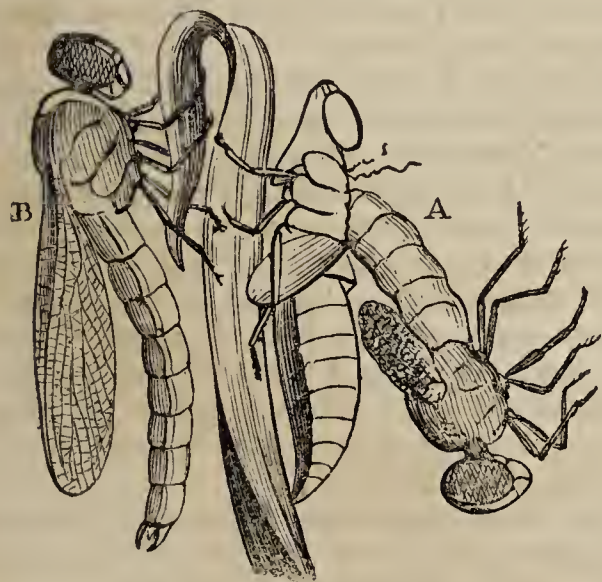
* Not only is the front piece let down as described by Messrs. Kirby and Spence, but the basal descending piece is subse-
quently capable of protrusion by a hinge at its base.

of this machine, take them, as it were, by surprise, when they think themselves safe. De Geer says it is very difficult for other insects to elude their attacks, and that he has even seen them devour very small fishes. As these animals are found in almost every ditch, you will doubtless lose no time in examining for yourself an instance of so singular a construction."

The formation of this organ varies slightly in the different species, but the same general structure is observable through the whole of them.

The observation of De Geer, quoted above, upon the motions of these larvæ and pupæ, arises in some respect from another remarkable peculiarity exhibited by them, consisting of an instrument which serves for progression, although more immediately connected with the office of respiration. These insects have, at the extremity of the body, an aperture serving for the entry of a certain quantity of water, which there undergoes a process by which the air contained in it is rendered serviceable for respiration. The orifice of this aperture is defended by five scaly pieces, forming a kind of tail, and which are opened or shut together at the will of the animal. When, therefore, a supply of water has been taken into the cavity, these external pieces are closed, and other internal organs brought into action, for the purpose of extracting the vital principle therefrom; and when this has been effected, the external pieces are suddenly thrown open, and the internal fluid discharged with violence, a sudden forward jerk being thereby given to the body of the insect.

These insects live in the water ten or eleven months preceding their final change, during which period they change their skins several times. From the middle of spring to the commencement of autumn, the *Libellulæ* arrive at their perfect state. The nymphs or pupæ, ready to become winged insects, are known readily by their larger size, and by the figure of their wing-covers, which become detached from each other. They now quit the water, and ascend the stems of any aquatic plant, so as to allow their outer covering to dry and become brittle. Some are ready to quit their old covering in the course of two or three hours; others are so much as an entire day before this takes place. After this



A, the dragon-fly making its exit from the pupa. B, the same drying its wings.

process has taken place, the pupa attaches itself to a twig by means of its legs. Internal movements are now perceived, and the skin splits down the back, the slit gradually increasing in size, until a sufficient orifice is made to allow the head and legs to be drawn out, the head being thrown backwards, and the

terminal abdominal segments still remaining in the pupa skin, serving to support the insect. After remaining some time in this position, it again raises its head and body, seizes the stem of the plant with its fore legs, and draws out the remainder of the abdomen. In this position it remains a considerable space of time, until its wings, which hang downwards (and which, at first, are not larger than the cases by which they were covered), acquire their full size and beautiful gauze-like appearance. At the end of a couple of hours the insect is able to support itself in the air on the wing.

There are numerous species of dragon-flies, of which many are natives of this country. Some of them, forming the modern restricted genus *Libellula*, are remarkable for the diversity of colour in the opposite sexes, the abdomen in the males being of a beautiful blue, and that of the female yellow. The largest species of the group found in England is the *Anax imperator*, a noble species, a solitary specimen of which we observed, during several weeks, hovering over the same little pond on Wimbledon Common, Surrey, during the present summer.

DRILUS (Olivier). A genus of coleopterous insects, belonging to the section *Pentamera*, sub-section *Serricornes*, and family *Lampyridæ*, having the antennæ remote at the base, the head not narrowed in front into a snout, and the eyes of ordinary size in both sexes. The females are, however, destitute of wings, and their antennæ are but slightly serrated, whereas those of the males are very strongly pectinated. The mandibles are slender and acute at the tips, with a tooth near the extremity.

The genus is composed of but a few small species, of which the males only, until very recently, were known. Naturalists were also ignorant of their metamorphoses. We are indebted to the Count Meilzinsky for the first account of the female, and the transformations of the genus, which, as well as the economy of the species, are very curious. The larva is about three quarters of an inch long, and is found in the interior of the shell of the common snail (*Helix nemoralis* of Linnæus), upon the inhabitant of which it feeds. When full grown (about the month of September), it remains for some time in an inactive state, during which period it was regarded by M. Meilzinsky to be in the state of the pupa. The observations of M. Desmarest proved such not to be the case. The latter author also ascertained, that, having remained in this inactive state until the month of May, the larva is transformed into a real pupa, in which state it continues perfectly inactive, unless when touched, when a drop of yellowish fluid is exuded from the sides of the body. M. Meilzinsky, not being aware of the connection of this insect with the well-known *Drilus flavescens*, regarded it as a distinct genus, to which he gave the name of *Cochleoctonus vorax*, establishing the genus upon the peculiarities observable in the large and unwieldy females, which are destitute of wings and wing-covers, like the glow-worm, and which nothing but direct observation would induce any one to regard as the other sex of the small and pretty drilus. M. Desmarest, however, assisted by his pupils, succeeded in rearing the apterous females from M. Meilzinsky's pupæ, and not only observed the coupling of the cochleoctonus and drilus, but also found, within one of the snail shells, the exuvæ of the male drilus, and which were easily recognisable from the peculiar construction of

the strongly pectinated antennæ, the cases of which were distinctly observable.

DRIMIA (Jacquin). A genus of bulbous plants, introduced from the Cape of Good Hope. They belong to the class *Hexandria*, and to the natural order *Asphodeleæ*. Generic character: corolla bell-shaped, six-cleft, segments revolute; stamens inserted into the base of the corolla; filaments as long as the corolla; anthers roundish; style protruding; stigma headed; capsule three-celled, many-seeded. Leaf-mould and loam mixed is the most suitable soil for these bulbs, which require no water when dormant, but they should be fresh potted before they begin to grow, to ensure their flowering, and propagated by offsets.

DRIMYS (Forster), is a tree introduced from the Straits of Magellan by Captain King. Class and order *Polyandria Tetragynia*, and natural order *Magnoliaceæ*. This tree yields the true *Winter bark*, a valuable medicine, and which would be a great acquisition if it could be cultivated in any of the British colonies.

DROMIUS (Bonelli). A genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and distinguished from *Demetrius*, with which it is united by the French authors, by its broader outline, shorter mandibles, simple fourth joint of the tarsi, and the greater length of the second joint of the antennæ. The species are of small size, and are found beneath the bark of trees, in sand and gravel pits, &c. They are very active, and often prettily ornamented. There are about fifteen British species, of which the synonyms are very confused. See the Second Part of the Transactions of the Entomological Society of London for a valuable paper upon the species of this genus, by Mr. Babington.

DRONE. A name ordinarily given to any moderately large and sluggish fly, but strictly belonging to the male of the hive bee. See **BEE**. Many dipterous insects, indeed, so much resemble bees, that it is difficult to convince the ordinary observer of nature that they are not stinging insects. The possession, however, of only a pair of wings, is sufficient to show their harmlessness so far as stinging is concerned. Moreover, even the true drone, although a four-winged hymenopterous insect, is destitute of any sting, that weapon of defence being given only to the females and abortive females, or neuters.

DROPWORT is the *Spiræa filipendula*, or Queen of the Meadow, a common British plant found on the banks of rivers, or on damp meadow ground. Three varieties of it are in flower gardens.

DROSERACEÆ, the Sundew family, a natural order of dicotyledonous plants, containing seven or eight genera, and between forty and fifty species. It is closely allied to *Violaceæ*, but differs in its circinate vernation, in having several styles, a minute embryo, and exstipulate leaves. It also bears a relation to *Saxifrageæ*, from which it is distinguished by its stamens being hypogynous.

Its essential characters are: sepals five, persistent, equal, with an imbricated æstivation; petals five, hypogynous; stamens distinct, withering, either equal to the petals and alternate with them, or two, three, or four times as many; anthers two-celled, opening longitudinally; ovary single, sessile; styles from three to five, more or less combined; capsule one to three-celled, and with from three to five valves which bear the seeds along the middle or at their base; seeds

either naked or furnished with an arillus; embryo straight, erect, in the centre of a fleshy or cartilaginous albumen; radicle directed to the hilum.

The plants belonging to this order are delicate herbs frequently covered with glandular hairs. Their leaves are alternate, and have a circinate æstivation.

They are found in marshy and inundated places, in many parts of the world,—in Europe, East Indies, China, Cape of Good Hope, North and South America, and New Holland.

Their properties are comparatively unimportant: some of them are acrid.

The chief genera are *Drosera*, *Dionæa*, and *Drosophyllum*.

Parnassia, formerly included in this order, is more properly referred to *Saxifrageæ*.

The genus *Drosera*, or Sundew, contains upwards of thirty species, three of which are natives of Britain. They are remarkable for their viscid glandular hairs, which detain and destroy insects. They are rather acid and slightly acrid, and are said to be poisonous to cattle. The leaves have the power of curdling milk. The name *Sundew* is derived from the circumstance of the leaves supporting small drops of a pellucid liquid like dew, even in the hottest part of the day, and in full exposure to the sun.

Drosera rotundifolia, *Ros solis*, or round-leaved sundew, is common in all the bogs of this country. It has a caustic juice which has been used to destroy warts or corns. *Drosera communis* of Brazil is stated to be poisonous to sheep.

A famous Italian liqueur is called *rossoli*, on account of one of the *droseras* being used in its manufacture. *Dionæa muscipula*, Venus's fly-trap, is a remarkable American plant, inhabiting the bogs of Carolina. Its leaves are all radical, and are terminated by two hemispherical lobes fringed with hairs. From the inside of each of the lobes three erect, irritable bristles proceed, which, when touched, cause the lobes to collapse suddenly like a rat-trap. By this means flies and small insects, attracted to the surface of the leaves, are frequently imprisoned and destroyed. The lobes afterwards gradually open and expand.

Drosophyllum Lusitanicum differs from the other *droseraceæ* in growing on the barren sands of Portugal.

DRYADEÆ is a section of *Rosaceæ*, and will be noticed under that order.

DRYANDRA (R. Brown). A fine genus of greenhouse plants, natives of New Holland. Class and order *Tetrandria Monogynia*, and natural order *Proteaceæ*. Generic character: common involucre imbricated; calyx four-cleft; stamens resting in cavities at the top of the calyx; four scales below the germen; folliculus woody, and two-seeded. These plants are nearly related to the *Banksias*, and require similar treatment. Sandy loam and moor-earth suits them best. Ripened cuttings, taken off at a joint, and planted in sand on a very gentle heat, under glass, generally make roots.

DRYPTA (Fabricius). A genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Bruchinides*, having the neck narrow, the head triangular, eyes prominent, the tarsi with the penultimate joint dilated, and the second joint of the antennæ long. This genus comprises but few species, one only of which, the beautiful *D. emarginata*, Fabricius, inhabits this country. It is very rare, of a rich blue colour, with the mouth, antennæ, and legs red. It is found upon the coast.

DUCK—*Anas*. A genus or rather family of web-footed birds, whose habits are, generally speaking, aquatic, though some of them are more on the land, and others more exclusively on the water. For their general relations to the rest of the feathered race, we must refer the reader to the article **BIRD**, and some of the particulars of their generic character will be found in the article **ANAS**, so that all we are required to do in the present article is to notice the habits and leading characters of the more remarkable species. If we take the family of *Lamellirostral*, or flat-billed birds, in its largest extent, it includes three groups, which have all many characters in common, though they have at the same time sufficient distinctions in appearance, structure, and habit, to warrant their being classed separately; and indeed the genus or group which we are now considering admits of subdivision into sections or subgenera, and perhaps into different genera. It is not, however, our object to enter into any of the niceties of system, which are usually uninteresting and unprofitable to general readers, very nearly in proportion to the trouble which they cost those writers to whom system is of more importance than knowledge; and thus we shall notice them, as far as possible, under their common English names. The greater divisions of the flat-billed family may be said to be three—geese, swans, and ducks, the first of these we shall notice under the article **GOOSE**, and the second under the article **SWAN**, so that in the meantime we shall have to notice only the **Ducks** properly so called. We may, however, mention, as introductory to the first division which presents itself to us in the alphabetical order, that there is a regular gradation in those three branches of this extensive and important family of birds. The geese are the least aquatic of the whole; and in the finding of their food they are birds of the bank and the meadow, rather than of the stream and the lake; and though the name goose is properly applied to some of the species which are marine or inhabit the sea, yet there is no sea bird to which the term can with strict propriety be applied. The geese are the most exclusively vegetable in their feeding of the whole race, and they very rarely eat any animal substance, neither are they seed-eating birds, for their principal food is grass or the green leaves of vegetables, especially such as grow near the waters. The swans are much more aquatic in their general habits, and seldom seek their food upon the land, or extend their journeys far from the water. They are, however, birds of the fresh water only, and though they are excellent swimmers they find their food either in the floating substances which are found in rivers and ponds, or in the roots of aquatic plants. They are indeed chiefly river birds, and prefer running waters to stagnant lakes and ponds, although they can live on the latter. The natural habit of both these divisions of the family is migratory, especially in the more tropical and the more polar parts of the world. This is easily accounted for, from the simple fact of their being aquatic birds; for during the dry season the tropical waters are entirely gone, and during the winter the polar waters are sealed up by the frosts, and therefore unavailable for any kind of bird. This holds more especially with geese and swans, which are birds of the fresh or land waters, than with ducks, many of which are birds of the sea, or at least of the shores of the great collections of salt water. That this should be the case will readily appear when we consider that

the fresh waters freeze much more readily than the sea does. There are several reasons why this should be the case. In the first place the fresh waters, whether river or lake, are confined to the particular latitudes in which they are situated; and do not receive any of the influence of more tropical latitudes, except through the medium of the air and the earth. In the second place those waters are generally speaking much shallower than the sea, and therefore much more subject to seasonal changes of temperature. This circumstance is attended with very considerable effects upon the distribution of fresh water birds, and is in fact one of the most effective causes in stimulating the migration of these animals. The fresh waters are much more heated, and much more productive both of animal and of vegetable life during the summer than the waters of the sea, and on this account they attract the birds during this season; but when winter comes, the sealing up of them by the frost puts an end to the supply, and such of the birds as have not seaward habits are forced to make their retreat to warmer climates during the winter.

Ducks are much more numerous in their species and much more diversified in their characters than either of the other two divisions of the family; and taking them altogether, they are perhaps the most interesting of the whole. Upon looking back to the article **ANAS** it will be seen that ducks admit of a natural division into three groups, two of which have very distinctive characters, while the third, which is intermediate, partakes more or less of the characters of both. They are also called by different names, not only in scientific classifications, but in common language, though the general character duck, founded upon the mallard or common wild duck, may be considered as typical of the whole of them. Such as are domesticated are very interesting and very valuable birds. They are much more intelligent, and have far more expression in their appearance than any of the races of poultry; and from their habits, their food, and their manner of feeding, they are much less destructive. Naturally they are very indiscriminate in their eating, but they cannot be kept in good condition or fattened so that their food may be wholesome unless they have access to pure water. Ducks which are kept in the streets and lanes of towns, to pick up any refuse that may be there, and left to dabble in impure and stagnant waters, have never a handsome appearance, neither are they wholesome as human food, and it is worthy of remark, as showing the condition of an animal in all the stages of its being, that the eggs of those improperly treated and unwholesome ducks are as unfit for food as the birds themselves. There is another mode of keeping ducks sometimes resorted to, which renders their flesh even more rank and unwholesome than that of those which walk the streets and dabble in the kennels; and that is a practice which is but too often resorted to by those butchers which kill their own meat, of keeping ducks in the yards of their slaughter-houses, to feed upon the offal and garbage. For this purpose they have generally a small nominal pond of water in the yard, but instead of water it contains a solution of blood and all other animal impurities, in a state of putrefaction, or one approaching to it; and therefore ducks which are fattened in such places are absolutely filthy, and partake as much of the nature of poison as of that of food. While remarking on the subject, we may as well add that pigs which are as miscellaneous feeders

as ducks, and which may be said to hold pretty nearly the same rank among mammalia that ducks do among birds, are often kept in the same places, and reared in the same offensive and unwholesome way.

When ducks are kept in proper situations, have due access to water, and are fed with proper food, they are very profitable animals; and though the flavour of their flesh is peculiar, and the fat, like that of all aquatic birds, is oily and indigestible, yet they are far from being unwholesome. They are also made more healthy than poultry, and we are inclined to think that they are more prolific; so that though they are adapted only to particular situations, they are birds eminently deserving the attention of country people. If they have access to running streams, or ponds of clean water, it is always preferable; but the common horse-pond at a farm-yard answers well enough for ducks; and as the pond itself serves many useful purposes, it might not be amiss if such ponds were more numerous, not only at farm-steadings, but at the cottages of labourers; as there are many little animals bred in the ponds which form wholesome and profitable food for the ducks, and at the same time cost nothing, either in expense or in trouble. Marshes and stagnant waters are objectionable in every country, because they poison the air for animal life, sour it for vegetation, and foster the growth of plants which are destructive both to the soil and to what is attempted to be grown upon it; but clear waters, on the other hand, tend equally to the healthiness and the fertility of the country.

Where there are ornamental pieces of water in pleasure grounds, ducks can always be introduced with very pleasing effect. This is the case not only with all the varieties of the common domesticated duck, but with even those species which, in their natural habits, are the most seaward, even with those which, in the wild state, are only seasonal or occasional visitants. These migratory ducks may not only be made to reside permanently on ornamental waters, but they may be tamed so as to come and be fed out of the hand, and, the pochards and gannets especially, are so neat in their forms, so beautiful in their plumage, and so lively in their motions, that it is impossible not to like them. In fact, there is perhaps no race of animals which can be turned to more pleasant and more profitable account than the whole family of the ducks.

But, though the ducks are thus highly interesting in every point of view in which animals can be interesting to man, they are comparatively little known, and their history, as in the state of nature, is very obscure. It has been but too much the custom with writers on natural history that, when they have been unable to point out the proper locality of any animal at any season, they have invariably "sent it to Siberia," put it into a sort of Arctic parenthesis. Thus it has fared with many of the ducks; but of those which have been described as rearing their broods in the inhospitable climes of the north, there are many which have never been seen there. The habit of the whole family in the breeding season is to be retired and silent, and as all the wild ones breed in places which are not easily accessible by man, we may naturally suppose that they pass that season in places where their presence is but little suspected. The writer of this article has sometimes, when fishing on sedgy streams in the uplands, hooked a mallard instead of a trout, in situations where the voice of the wild duck

had not been heard for months; and therefore he is inclined to believe that many of those species which are described in the books as being only winter visitants are resident birds, only that they pass the summer dispersedly and in places where they have but little chance of being seen. The males are peculiarly retired and silent after the pairing time, and the female does not come abroad until she is able to launch her young ducklings upon the waters. And there is not a finer sight in the whole of living nature than this first launching of the ducklings upon that element of which they are in future to be so much the ornaments.

We shall now give a short enumeration of the leading species of these very interesting birds, beginning with those which are the most landward in their habits; and without particular attention to the three divisions which we mentioned in the article *ANAS*, however, there is so regular a gradation in the whole, that it is not very easy to say where the one begins and the other ends. There are, however, two structural divisions which are not unworthy of attention, as they form good indications of the habits of the birds. They consist of those which have the hind toe free, and those which have it webbed, and more or less connected with the inner toe in front.

The whole of the duck tribe, whether those that are more landward, or those which are more aquatic in their habits, find their food more by the sense of touch than by that of sight, and the bill is a very beautifully organised instrument. It is covered by a sentient membrane, and the edges, which come in contact, are covered with papillæ, and abundantly furnished with nerves, so that, when a duck dabbles in the water, the feeling of the bill enables it to distinguish eatable substances from the sludge and pebbles with which they are mixed, and it literally "sifts" or "palts" the matters which it catches at the bottom of the shallows.

In this character of the bill the ducks are very superior both to the geese and the swans. They are also much more compact in their plumage, and altogether better fitted for the water. They are also gayer in their colours, and in many of the species, the males especially, are very beautiful. One external character which distinguishes the greater number of the ducks from all other birds, is a spot on the secondary quills of the wings. This spot is always different in colour from the surrounding parts, and it generally is glazed with rich metallic reflections, on which account it is designated the "speculum" and the "beauty spot."

We shall now notice the leading species, beginning with those which have the hind toe plain, or without any membrane or web; these also have the legs articulated more forward, the tarsi larger and rounder, the toes shorter, and the whole foot more adapted for walking; they also have the wings larger, and, as one would say, more aerial in their structure. It does not follow from this that they are better flyers, for some of the diving ducks are very alert on the wing after they have gained their height, but the feathering of the wings in the landward ducks is much less compact than in the diving ones. The latter use the wings as a fin or paddle in making their way under water; and to adapt it for this purpose, there is a very beautiful compactness in the feathers upon both sides of the wings. The wings, and, generally speaking, the whole plumage of these birds,

is waterproof, and this quality is inherent in the feathers, of their very nature, and not produced by the application of the oil which is secreted by the gland at the rump; that the secretion of this gland is used by birds in the "preening" or trimming of those feathers, is certain; but that it is the means by which these are rendered waterproof, admits of considerable doubt; and the doubt is increased by the fact, that the feathers on the head, and those other parts which cannot be reached by the bill in preening, are just as much waterproof as those which can be so reached. It is therefore probable that the oil of the gland answers the purpose of preventing the feathers from adhering to the mandibles in the act of preening rather than that of rendering the feathers themselves waterproof afterwards. This is a subject, however, upon which information is still very much wanted, though it is one which we might suppose is very open to observation.

This arises, in a great measure, from the seasonal habits of the birds, and it is common to the whole of them. Whether they leave the country or not during the breeding time, they always disperse, and live in retirement in the fens and marshes, and, generally speaking, in situations as inaccessible as possible. Their nests are usually concealed in tall herbage, though there are instances of the same species building on trees at a considerable height above the ground. It seems, indeed, to be concealment, rather than the close vicinity of the water, which is their object at this time. In the American marshes, to which vast numbers of these birds resort when the season sets in, the nests are, we believe, chiefly upon the stumps of trees, or upon bushes, as the ground is generally flooded about the time that the nesting commences; and some specimens from that part of the world, which were at the gardens of the Zoological Society, did not make any attempt at nest-building until the keepers fell upon the contrivance of placing a stake in the pond, upon the top of which a nest was soon formed. The whole race are, indeed, exceedingly cunning birds when in a state of wild nature, although, as we have said, they are so easily tamed, and so capable of attachment.

The great length of time which the feathers of flight require before they come to maturity, is another means which prevents any of the duck tribe from being seen ranging in the summer. They are prolific birds, the eggs being from ten to eighteen. They pair in spring; the incubation lasts about thirty days, and the young break the shell in the course of May, sooner or later, according to the season and the situation; but, though the young are very active in the water, and very fond of it from their very first appearance, it is a long time before they become so completely fledged as to be able to use their wings. Before this event, the old ones have mounted, and the whole may be said to be unfit for long flight before the month of August, or even September. But the time which they spend in the fens and marshy places is that at which such places abound most in small animals, and when they are least covered with water. Thus the ducks fare plentifully; and though the growth of their very close plumage is rather a severe operation, they are said to be in better condition while moulting than many other birds are. In former times it was customary to "drive" the young ducks, and also the old ones, while moulting, by a sort of general assemblage of

the people in the fen countries; and this sport, if sport it could be called, was often so successful as that a thousand birds were taken in one day. This was most practised in Lincolnshire, and the other fen counties, and was performed with a large net; but it was considered so destructive of the breeds of the animals, that the protection of Parliament was extended to the ducks, at least for the period between the 1st of June and the 1st of October, which includes all the rearing of the young birds, and the recovery of their feathers by the old ones. The slow growth of the first feathers of the wings is a very certain means of distinguishing young birds from old ones. If, upon pulling a feather, the extremity of the pipe or barrel has blood in it, the bird is young; but if the end of the feather is dry, the bird is old, at least, it is not a year's bird, and these are always the most delicate, the rankness of flavour, and also the toughness, increasing with the age of the birds.

Ducks (we speak of them as in a state of nature only) are not game, neither are they in themselves property; and when they are in the estuaries, or otherwise on the broad waters, they are *feræ naturæ*, and may be shot, or otherwise captured, by any one who is afloat upon the water. If, however, they are on any land which is property, they belong to the proprietor while they remain there, and the taking of them in such a situation is a trespass. The places where ducks haunt, when they are in season, are not, however, the most inviting ones for genteel sportsmen, and consequently trespass is not so much attended to as in most cases.

When the ducks flock they come to the estuaries and the low flats, where a considerable extent of sludgy ground is alternately covered and left by the tide. Such places contain, during the winter months, a vast quantity of animal matter, partly that which has been washed down by the autumnal rains, which sweep a vast quantity of little animals and animal remains from the upper country, and partly also by small aquatic animals, which resort thither for the purpose of enjoying that warmer temperature which the top of the brackish water is known to possess over both the salt water of the sea and the fresh of the river. The deposits which are thus formed, and which are the grand attractions for the dabbling birds, are always great in proportion to the richness of the country, and the gentleness of the slope over which the water descends. The first of these furnishes the supply, and the second brings it down more gradually, but at the same time more copiously and completely, than if the stream ran with more violence. Rivers which flow from large lakes by short courses, and also rivers which come dashing through rocks, never form estuaries very favourable for ducks. Hence we have only to look at the map, and study the general features of a country, in order to ascertain whether its shores are or are not well adapted for the winter resort of these birds.

Now, when we look at the estuary of the Thames, and also to many parts of the south coast of England, we find that they have the duck characters in a very eminent degree. None of the rivers come from lakes; their courses are, generally speaking, on a gentle slope with out-falls or interruptions; the country through which they come is rich, and there are vast accumulations of mud. In consequence, the catching of wild ducks, in which all the species are included, though some of them are known by different names,

both popular and scientific, is carried on systematically in those places, and the quantity captured is far greater than one would suppose. There are various methods of doing this; but the chief, in point of success, is the *decoy*; and instances have been known of eight hundred pounds being cleared one year by a single decoy on the coast of Essex.

These decoys consist, in the first place, of an expanse of water, which is called the pond, and which is placed in the shelter of reeds, and, generally speaking, also of bushes. The banks of the pond are left clear for some little way, so that the birds may rest upon land, and, in short, this portion of the contrivance is made as tempting as possible, as much of the success depends upon this requisite. But, though the ducks resort to the pond in vast numbers, and pass the day in an inactive state, yet still great skill, or, at all events, practice, is required in examining the pond, because they are exceedingly watchful, take wing on the least alarm, and do not readily settle. The sense of smelling is remarkably acute in those birds, as one might naturally suppose, from the margins of their bills being so copiously supplied with nerves. In consequence of this, when it becomes necessary to approach them on the windward, it is usual to carry a little bit of burning turf, the acid smoke of which counteracts the smell of the carrier, which would be sufficient to alarm the birds, except for this precaution. The inland extremity of the pond is formed into pipes, or funnel-shaped channels, which narrow gradually, and have at the end a permanent net placed upon hoops. This net forms the trap in which the birds are taken often in vast numbers at one time. In order that the decoy may be worked in all weathers, it is necessary that there should be one to suit each of the prevailing winds. We need not farther go into the details of this mode of bird-catching. The ducks are enticed by tame ones, which are trained for the purpose; and it is from them that persons employed to entice others to their injury are called "decoy-ducks."

These birds begin to be taken in October or November, and the taking continues till the end of February, between which time and the following October operations are prohibited. Besides these decoys, there are, in the places where ducks are numerous, many of the country people who shoot them. These are called *punt-shooters*, or *punt-gunners*, in the creeks and openings of the streams in the lower part of the Thames estuary; and as they ply night and day, according as the tide answers, their labour is very severe. In the south of England it is a still more serious labour; and as the following account, drawn up by Gilpin, is very characteristic, we shall introduce it:—"The coast between Hampshire and the Isle of Wight is peculiar, consisting, at ebb-tide, of vast muddy flats, covered with green seaweed. It affords the fowler an opportunity of practising arts perhaps not elsewhere resorted to. Fowling and fishing are indeed, on this coast, commonly the employments of the same person. He who, in summer, with his line or net, plies the shores when they are overflowed by the tide, in winter, with his gun, as evening draws on, runs up in his boat among the creeks which the tide leaves in the mud-sands, and lies in patient expectation of his prey. Sea-fowl usually feed by night, when, in all their multitudes, they come down to graze on the savannahs of the shore. As the sonorous cloud advances (for their

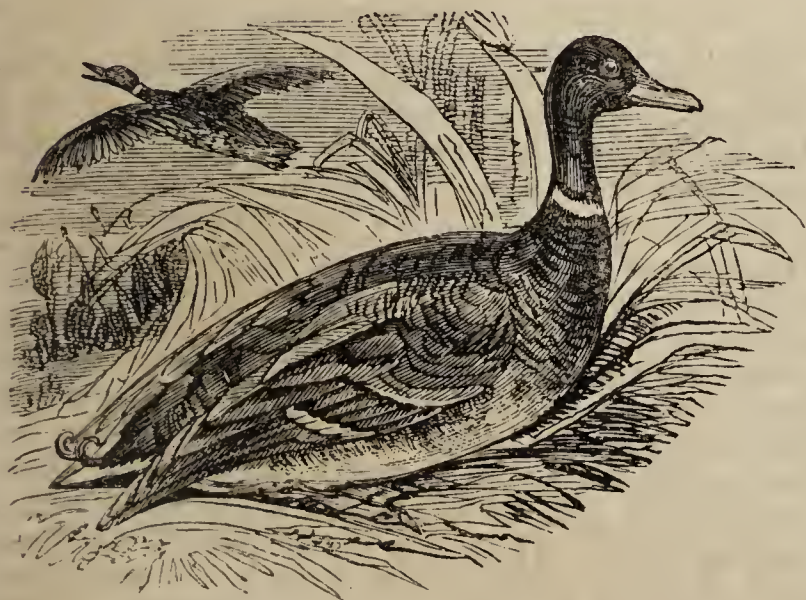
noise in the air resembles a pack of hounds in full cry), the attentive fowler listens which way they bend their course. Perhaps he has the mortification to hear them alight at too great a distance for his gun (though of the longest barrel) to reach them, and, if he cannot edge his boat round some winding creek, which is not always in his power, he despairs of success that night. Perhaps, however, he is more fortunate, and has the satisfaction to hear the airy noise approach nearer, till at length the host settles in some plain upon the edge of which his boat is moored. He now, as silently as possible, primes both his pieces anew (for he is generally double armed), and listens with all his attention. It is so dark that he can take no aim, for, if he could discern the birds, they would also see him, and, being extremely timorous, would seek some other pasture. Though they march with noise, they feed in silence; some indistinct noises, however, if the night be still, issue from so vast a concourse. He directs his piece, therefore, towards the sound, fires at a venture, and, instantly catching up his other gun, discharges it where he supposes the flock to rise on the wing. His gains for the night are now decided, and he has only to gather up his harvest. He immediately puts on his mud-pattens (flat square pieces of board, which the fowler ties to his feet, that he may not sink in the ooze), ignorant yet of his success, and goes groping about in the dark in quest of his booty, picking up sometimes many, and perhaps not one. So hardly does the poor fowler earn a few shillings, during a solitary winter night, be the weather as it comes, rain, hail, or snow, on a bleak coast, a league probably from the beach, and often liable, without great care, to be fixed in the mud, when he would become an inevitable prey to the returning tide. One of these poor fellows, I have heard say, never takes a dog with him on these expeditions, because no dog could bear the cold which he is obliged to suffer; and, after all, others frequently enjoy more from his labours than himself, for the tide often throws next day, on different parts of the shore, many of the birds which he had killed, but could not find in the night."

This hazardous occupation once led a fowler into singular distress. It happened, too, in the daytime, which shows still more forcibly the risk of such nocturnal expeditions:—"Mounted on his mud-pattens, he was traversing one of these oozy plains in search of ducks, and, being intent only on his game, suddenly found the water, which had been accelerated by some peculiar circumstance affecting the tide, had made an alarming progress around him, and he found himself completely encircled. In this desperate situation an idea struck him as the only hope of safety. He retired to that part which seemed the highest, from its being yet uncovered by water, and, striking the barrel of his long gun deep into the ooze, he resolved to hold fast by it, as well for a support as a security against the waves, and to wait the ebbing of the tide. He had reason to believe a common tide would not have flowed above his middle; but, in the midst of his reasoning on the subject, the water had now reached him. It rippled over his feet, it gained his knees, his waist, button after button was swallowed up, until at length it advanced over his shoulders. With a palpitating heart he gave himself up for lost. Still, however, he held fast by his anchor; his eye was eagerly in search of some boat which might accidentally be

passing, but none appeared. A head upon the surface of the water, and that sometimes covered by a wave, was no object to be descried from the land, at the distance of half a league; nor could he exert any sounds of distress that could be heard so far. While, as the exigence would allow, he was thus making up his mind to the terrors of certain destruction, his attention was called to a new object. He thought he saw the uppermost button of his coat begin to appear. No mariner floating on a wreck could behold approaching succour with greater transport than he felt at this transient view of the button; but the fluctuation of the water was such, and the turn of the tide so slow, that it was yet some time before he durst venture to assure himself that the button was fairly above the level of the flood. At length, a second button appearing at intervals, his sensations may rather be conceived than described, and his joy gave him spirits and resolution to support his situation four or five hours longer, until the waters had fully retired." This tale of tribulation in the flats may serve as a striking counterpart to some of those of which we read as taking place among the wild and rocky shores in regions farther to the north; and with it we shall close our general notice of this very interesting family of birds.

The species are so very numerous, and their manners are so much alike, that it will not be necessary to go into a minute description of each; but we shall notice a few in each of the two divisions. And, first,

Ducks with the hind toe free. The common WILD DUCK, or MALLARD (*Anas boschas*), is not perhaps the most typical duck of this division; that is to say, it is not the one which is the least aquatic in its habits, but still it is the bird from which the name is taken; and when we use the word duck, without certifying it by some epithet, it is always this one which is meant. This is also the largest in size, at least of the species which frequent this country; and though its flesh is not reckoned so great a delicacy as that of some of the smaller ducks, it is the one which appears most frequently at market. It is from the female that the general name duck is taken, while the male is the mallard, or drake.



Mallard.

The length of a full-grown mallard is about two feet, the stretch of the wings about three feet, and the weight about two pounds and a half, though there are some individuals which are heavier than this. The bill is greenish yellow, the irides hazel, and the feet

orange, with a tinge of red. The head and neck are of a dark green colour, remarkable alike for its gloss and for the fineness of the feathers. Below this there is a white collar; and the neck, breast, and shoulders, are purplish brown. The scapular feathers are a mixture of silver-white and rust colour, finely streaked with waving lines of brown. The wing-coverts are ash-coloured, with white and black on the tips, and the primary quills are dusky black. The wing-spot, or speculum, on the secondaries, is rich purple, with metallic reflections of blue and green. The lower part of the back, the rump, the tail-coverts, and the four middle tail feathers, which are curled up in the mallard, are black, with green reflections on the rump, and purple on the tail. The other feathers of the tail are dusky brown, margined with dull white. The under part, from the breast downwards, is whitish grey, with slight mottlings of brown. The duck is considerably smaller than the mallard, and wants the green and white on the head and neck. The general colour is rusty brown, lined and mottled with black, and she is without the curled feathers on the tail; but the speculum on the wing very much resembles that of the male bird.

SHELDRAKES (Tadorna). There are several varieties of these birds, the distinctions of which are tolerably well marked in a state of nature, though each variety is remarkably true to its own particular colour and marking. This is the case also with the mallard in a state of nature, though, as is more or less the case in all animals, the colours are broken down in the domesticated state. The sheldrakes have the bill much flattened toward the extremity, but the upper mandible is enlarged into a globular protuberance at the base. This character has a slight approximation to that of the goose, and there is a slight similarity in the air of the birds, though the sheldrakes are by much the more handsome birds. One character by means of which the degree of aquatic habit in different ducks may be judged of, is the particular mode in which the head is carried; for, in proportion as the ducks are in the habit of diving, they have it folded on the shoulders, and again recurved when they are in a state of repose. Their neck is an instrument to be used wholly or chiefly under the water, and thus it is held in that position in which it can most easily cleave the surface, and enable the bird to dive; whereas those species which carry the head with the neck more stiffened, use the bill more on the surface, and, generally speaking, too, they eat some portion at least of the aquatic vegetation, as well as animal matters. The sheldrake is a good confirmation of the truth of this, as it has at once most of the structure and most of the habit. There are three species of sheldrakes found in different parts of this country, and as they are less aquatic than the others, they are more resident; for it is worthy of remark, that those aquatic birds which are most seaward in their habits are also the most discursive from place to place.

The COMMON SHELDRAKE (*T. vulpanser*). These are handsome birds, and birds of very quiet dispositions, and not very difficult to tame in the individual, though they do not breed readily in confinement, and therefore would not be so profitable for domestic purposes as the common duck; their flesh, also, is rank in its flavour. These birds inhabit the line of the water, or near it, rather than the fens or the broad waters; they lurk in holes along the beaches,

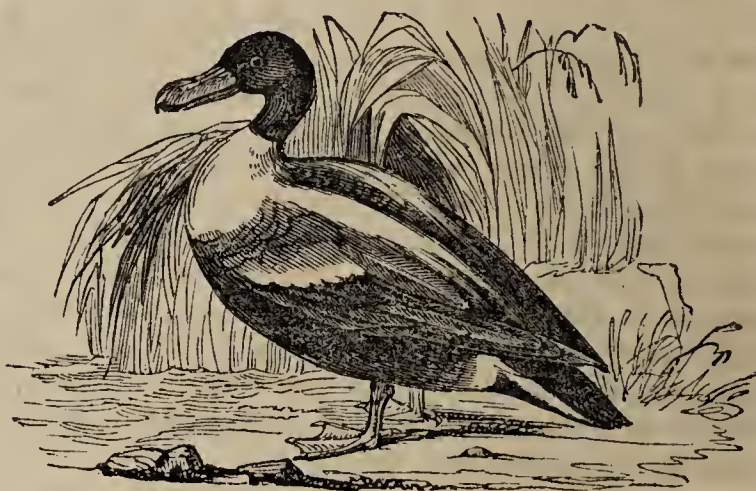
in which the female deposits her eggs, which are from ten to fifteen, and of a white colour. The places where those nests are found bear some resemblance to the nesting-places of the eider ducks, and there is a correspondence of habit. The females of both cover their eggs with the down which they pull from their own breasts; but, as the present species sits in less exposed situations than the eiders, a smaller quantity answers the same purpose. The male, however, takes his turn at sitting, while the female is abroad in search of her food, which is early in the morning and late in the evening, but she is never long absent from the nest. Their food appears to consist principally of insects, small crustacea, and the spawn and small fry of fishes. As they do not range any great breadth of surface in quest of food, each pair occupies some portion of the line of coast as a sort of preserve; and as they do not flock during the great gathering of water-fowl, more than two are seldom seen together.

The lineal dimensions of the sheldrake, and also the weight, are nearly the same as those of the mallard, but the gait and markings are very different. The sheldrake has a little of the strut and swagger of the goose. The feet, and greater part of the bill, are of a reddish colour; but the basal enlargement of the bill, the openings of the nostrils, and the nail on the tip, are black; and we may add, that the distinctness of this nail is another approximation to the characters of the goose. The head and neck are of a beautifully rich green; the lower part of the neck, the back, the rump, the tail-coverts, and basal part of the tail-feathers, are white. There is a band of reddish bay, which forms a collar on the lower part of the neck, and proceeds along the sides and flanks, and through this band a list of blackish brown extends to the vent. The outer half of the scapulars, and the principal quills, are black, and the secondaries glossed with a wing spot of green and purple reflections. In so far as colour is concerned, the sheldrake is one of the handsomest of our aquatic birds. The female has much more resemblance to the male than in the common wild duck, being only rather less in size, and not quite so bright in the colours.

The RUDDY SHELDRAKE (*T. rutila*). This species has the bill and the head smaller than the former, and the front and cheeks are white, extending to behind the eyes; the remainder of the head, and upper part of the neck, rusty brown; the body pale chestnut; the wing-coverts white; the primary quills, the rump, and the tail, black; and the wing-spots green, with purple reflections. These birds are exceedingly rare in Britain, even as stragglers, for it is not the habit of the genus to straggle much; they are, however, described as being very plentiful on the continental shores of the North Sea, and also on those of the Baltic, where the country near the coast is sandy, and the sand blown into hummocks or hillocks, or, as the French call them, *dunes*, which is very apt to be the case in such places. Among those diversified surfaces, which are generally protected, in great part, by a strong coating of bent, which gives place to more kindly herbage as the sea continues to recede, which it almost invariably does from those sandy shores. These places generally abound in rabbits and rabbit-holes, of which the sheldrakes take possession, and use them as their nesting-places; and it is for this reason that the common sheldrake has got the name *Vulpanser*, the fox-goose.

The SHOVELLER (*Spathulea chlypeata*). It is probable that there are varieties of this bird in those parts of the world which are well adapted to its habits, and at the same time far apart from each other, but only one is satisfactorily made out as an inhabitant of Europe; and we still want a good account of the wild ducks of tropical countries, and of countries in the southern hemisphere, more especially of New Holland, which, from the quantity of rain that falls at certain seasons, and the want of any other means than evaporation to dry it up, must make that part of the world, seasonally at least, a great duck country; and, as that is the quarter of the world in which modern discovery has found the *rara avis*, or impossible bird of the ancients, we may be prepared to meet with some novelties when the interior of that country is a little more carefully explored.

The shoveller is a very handsome bird, only its bill is disproportionally large, and very peculiar in shape. It is about three inches in length, of a black colour, widened toward the extremity; and the fibres along the margin are so much produced, that the bill has the appearance of being surrounded all along the gape with a fringe of hairs. This form of the bill is well adapted to the habit of the animal, which is that of picking up very small animal matters in the shallows and runs of the rivers; and as these fibrous appendages are very sensitive, they enable it to detect with great nicety all substances that are edible.



Shoveller.

The shoveller is a much more inland bird than the sheldrake, and it is also rather more discursive. It is found, we believe with very little difference of appearance, both in the eastern continent and the western; but, so far as is known, it is a bird of the northern hemisphere, or northern migration only, and is not met with in any part of the south. There are, however, several ducks of New Holland, and some of New Zealand, which have the gape of the bill bordered with membrane, and the structure of the organ suited for nearly the same purposes as that of the shoveller; but we are not sufficiently acquainted with the habits of those races to be able to speak with much certainty regarding them. Their bills are in general bordered with an entire membrane, or, at least, one forming a less decided fringe than that of the shoveller. On the continent of Europe it is pretty abundant, and it breeds in the marshes of the middle latitudes; but in Britain it is not a very common bird, even in the fens. In America, it, or rather perhaps they (for there seem to be varieties in America), appear to be much more migratory than they are in the eastern

continent. This, however, does not establish any difference in the birds themselves, but may readily be accounted for in the difference of the two countries. The American summer is more dry than the European, and the American marshes, in the middle latitudes, partake of this drought, or, if they do not, they are covered with junipers and other evergreens, so that they do not answer well for the summer resort of dabbling birds. The northern latitudes of America, again, are remarkably well adapted, on account of their flatness, the abundance of water, the high temperature, and the correspondingly great production of small animals. Yet, in respect of latitude, the climates to which the shoveller moves northward, during the American summer, are not more northerly than those in which it breeds in central Europe, although, from the different character of the seasons, it ranges more in the one country than in the other. In all countries where it is known, this bird forms its nest in the tallest and thickest tufts of rushes and other aquatic herbage, and, generally, also in places which are not accessible by man, or, indeed, by any of the land mammalia. The nest is rudely formed of withered grass, collected in considerable quantity, and the female is a close sitter. The eggs are about ten or twelve in number, of a pale rust colour, and the young are led to the water by their parent as soon as they appear. At this stage they are rather uncouth, from the great development of the bill in proportion to that of the body. It is always worth while to notice the order in which the organisation of an animal is developed, or it comes to maturity, because this is one of the best guides to the habits of the animal. The young shovellers have to find their food in the water, and therefore they have the feet and the bill in a tolerably complete state when they come out of the shell, whereas the organs of flight are then in a rudimental state; and they continue so much longer than they do in birds which are obliged to make use of the wing at an early stage of their existence. This slow production of the organs of flying, is general among birds which seek their food upon the ground, whether in the shallow waters, the marshes, the fields, or the uplands; but all of them are better provided for the use of their feet, and also of their bills, than birds of more early flight. Thus we see how well these creatures are adapted to the particular places in which they reside, and to which they are, of course, drawn by this very adaptation. The shoveller is thus described: the bill is of a brownish black colour, three inches in length, greatly widened near the extremity, closely pectinated on the sides, and furnished with a nail on the tip of each mandible; irides, bright orange; tongue large and fleshy; the inside of the upper and outside of the lower mandible are grooved so as to receive distinctly the long separated reed-like teeth; there is also a gibbosity in the two mandibles which do not meet at the sides, and this vacuity is occupied by other appendages; head and upper half of the neck, glossy, changeable green; rest of the neck and breast white passing round and nearly meeting above; whole belly dark reddish chestnut; flanks, a brownish yellow, pencilled transversely with black, between which and the vent, which is black, is a band of white; back blackish brown; exterior edges of the scapulars, white; lesser wing coverts and some of the tertials a fine light sky blue; beauty spot on the wing, a changeable resplendent bronze green, bordered above by a

band of white, and below with another of velvety black; rest of the wing, dusky, some of the tertials streaked down their middles with white; legs and feet, reddish orange. The female has the crown of the head of a dusky brown colour, and the rest of the head yellowish white, thickly spotted with dark brown, the spots on the breast being larger and crescent-shaped. The back and scapulars are dark brown with orange shafts and margins to the feathers. The under part is white with a slight reddish tinge. The wings differ little from those of the male bird, and, indeed, in all kinds of ducks, it is in the wings that the two sexes correspond the most with each other.

THE GADWAIL (*Chauliodus strepera*). The gadwall is still smaller than the shoveller; like that, it is an inhabitant of marshy situations in both continents during the summer or breeding season; and it is probable that, in Europe, these birds follow the line of the central marshes rather than that of the meridian. They seldom reach the shores of Britain, and when they do it is only to the places that are most contiguous to the marshy countries on the east side of the North Sea. They are, probably, less seen in proportion to their numbers than almost any other species of duck, as their habits are very retired, and it is rarely, indeed, that they come out except during the night. In America, though the birds are not very rare, they have precisely the same habits; and as it is no easy matter to range the American marshes, the breeding places in that continent are not known. The male bird is thus described—length about nineteen inches, breadth about thirty-three, bill two inches, flat, and of a black colour; markings of the plumage exceedingly minute, giving it a sort of appearance as if it were marked with delicate stripes, and enclosed in a net-work. The ground colour of the head and neck is grey, marked with brown points; but the lower part of the neck, the back, and the breast marked with small black crescents; the scapulars and flanks pencilled with zigzag lines of black and white. Lesser coverts of the wings chestnut; greater coverts, rump, and tail coverts, black. Primary quills of the wings dusky, tail reddish, but white at the tip, which is very much pointed; under part white, and the wing-spot white, with a red margin on the one side, and a chestnut-coloured one on the other. The female differs in having the wing-covert duller, more brown on the neck and back, and wanting the crescent spots on the fore part, and the fine pencillings on the flanks and scapulars; she is also rather smaller in size than the male. The nest is always constructed in a place of great concealment, such as a thick tuft, a close bush, and sometimes the hollow of a tree; and the birds glide so softly, and at the same time so swiftly through the herbage, that they may be close at hand without the least chance of noticing them. These birds are not quite so prolific as some of the others, the eggs in a hatch being about eight or ten in number, of a greenish ash-colour. The flesh of the bird is held in much estimation. This duck, though it has not the web on the hinder toe, is a very expert diver; and for this reason it cannot be shot while swimming without the greatest difficulty; it is very watchful, and as it plunges the instant it sees the flash, it can scarcely be hit by the best directed shot.

TEAL (*Querquedula*). There are several species to which this name is applied in common, and they are remarkable for the beauty of their colours, and also for the superior flavour of their flesh; and it is probable

that some of these have been multiplied by considering difference of age and sex as difference of species.

THE PINTAIL (*Q. acuta*). This is a very beautiful species, both in its form and its markings,—one of the chief ornaments being the produced tail, which is of considerable length, pointed, of a black colour, glossed with rich green reflections. This very handsome species is a native both of the eastern continent and of America; and we shall not be able to give a better account of its distribution and habits in the latter continent than by the following quotation from Wilson:—"The pintail, or as it is sometimes called, the sprigtail, is a common and well-known duck in our markets, much esteemed for the excellence of its flesh, and is generally in good order. It is a shy and cautious bird, feeds in the mud flats, and shallow fresh water marshes; but rarely resides on the sea coast. It seldom dives, is very noisy, and has a kind of chattering note. When wounded, they will sometimes dive, and, coming up, conceal themselves under the bow of the boat, moving round as it moves; are vigilant in giving the alarm on the approach of the gunner, who often curses the watchfulness of the sprigtail. Some ducks, when aroused, disperse in different directions; but the sprigtails, when alarmed, cluster confusedly together as they mount, and thereby afford the sportman a fair opportunity of raking them with advantage. They generally leave the Delaware about the middle of March on the way to their native regions, the north, where they are most numerous. On the marshy shores of some of the bays of Lake Ontario, they are often plentiful in the months of October and November. I have also met with them at Louisville, on the Ohio." In the eastern continent this bird is pretty generally distributed, though, as is the case with many of the tribe, its movements at different times of the year are not generally known. We can hardly suppose that, though it does come to the open waters in the winter season along with the rest, it retires very far to the north in the summer; because in winter it is more abundant in the south of England than in the north; while it is very rare in the south of Scotland, and hardly known in the northern parts of that country. The difference between the seasonal migration of insect-feeding birds that resort to our groves and copses, for the purpose of nidification in the summer season, and return to more southerly climates in the winter, is a subject upon which we stand in need of much additional information. We are too apt to conclude that both are subject to a similar kind produced by similar causes; and that the aquatic birds which come to us in winter, or at all events make their appearance in winter, have only a more northerly locality upon the globe than our summer migrants. The habits of the two races, their food, their time and manner of feeding, and every thing about them, are, however, so different from the others, that we can establish no well-founded analogy, or draw from the one any conclusion that will rationally apply to the other. The summer birds are, with very few exceptions, day feeders, and retire and are silent during the night; and, therefore, we can readily suppose that the longer daylight in the higher latitudes, during the summer months, must be at least one of the reasons why they resort to those latitudes. But, on the other hand, the winter birds are chiefly night feeders, or at all events feeders in the morning and evening twilights, and that they remain inactive during the day, even when they

have the severest labour to perform. It must be understood, however, that their labours in the rearing of their broods are very light compared with those of the warblers in the groves. They do not expend so much care in the forming of their nests, and at that season they have very little wing work; neither do they require to collect and carry food for their young, as is done by all birds whose habit it is to remain in the nest till their feathers of flight are nearly perfected. Thus, the rearing of a single sparrow, or swallow, perhaps, costs its parents more hard labour than the rearing of the largest brood of wild ducks. The migrations of the air birds are pretty well known; and thus it is the habits of the aquatic ones, respecting which we stand in want of most information; and when we consider that, in places suited to them, the duck family can find their food in all weathers, and bear all climates with nearly equal ease, the probability is that they will be found to breed much more indiscriminately in the humid parts of all countries, than is generally supposed.

The following is an outline of the external characters of the pintail. The bill of moderate length, black in the middle, but of a bluish colour at the sides, on which account it is called the blue-bill in some parts of America. The head is round, and the neck long and slender: the nape and hind part of the neck are dusky; and the top of the head and fore part of the neck rich dark brown; while this colour is separated from the former by a narrow white line down each side of the front. These lines are broader as they advance forward, and uniting, form a pretty large collar on the lower part of the neck, and the upper part of the breast. The remaining part of the breast, and the sides of the neck and middle of the back, are marked with fine lines of black and white, and the flanks and lower part of the back are mottled with the same colours. The scapulars are long and pointed, black in the centre, bordered with white; and the hand pendent over the bend of the closed wing. The coverts are brownish and tipped with pale orange, and the wing-spot is purple with green reflections. The quills and feathers of the tail, with the exception of the two produced and more finely-coloured ones in the middle, are dusky. The markings of this bird are altogether very beautiful; but as the form of the tail is subject to some variations in different individuals, these have been sometimes elevated into varieties without any just cause.

COMMON TEAL (*Q. crecca*). This is rather a small species; but its colours are very beautiful, and it is highly esteemed as food; the flesh being sometimes sold in the London market as high as five shillings a pound. The male is about fourteen inches long, twenty-three in the stretch of the wings, and about twelve ounces in weight. The female is a fourth lighter, and of a smaller size in proportion. The feet and bill are dusky; and the irides pale hazel: in the male the head and upper part of the neck bay with a broad bar of glossy variable green, bordered with a white line on the under side, extending from the bill to the hind part of the head on each side. The fore part of the neck and breast are dull white, marked with roundish black spots. The belly is white, the vent black; the coverts of the wings brown, and the quills dusky; but the outer webs of the secondaries are marked with a green spot, with a white line above and below, and a black bar over it. In the breeding season the breast of the male acquires a slight tinge of salmon-colour. The

female is all over of a brownish ash-colour, with part of the sides and the belly white, the vent also white, but with a green spot on the wing, resembling that of the male, only less bright in the colour.

The common teal spends the winter season in a state of very great concealment; so that very little is known of its breeding places. There is no doubt, however, that it breeds among the reedy pools near the margins of most of the humid districts, more especially in the richer parts of the country. Indeed, it is not uncommon in the more retired morasses in most parts of Britain, and also of the eastern part of the continent, generally, as there is nothing to give it a decided seasonal migration in latitude. It is met with as far to the north as Iceland, and as far south as between the thirtieth and fortieth parallels of latitude; and it is highly probable that its character, in every part of this wide range, is that of a resident bird. In tidal rivers the teal feed chiefly when the water is at an ebb; and are driven from their grounds as the tide rises, and as their haunts are among the tall reeds some art is required in arriving at them. The nest is carefully concealed among the herbage, and composed of a very considerable quantity of grass and stalks lined with finer ones, and sometimes with a few feathers. The eggs are numerous, being from ten to sixteen or seventeen; they are about the same size as pigeons' eggs, and of a dull yellowish colour.

GARGANY, or SUMMER TEAL (*Q. circia*). This species is about the same size as the common teal, which it resembles in very many of its habits, though the body is a little more elongated, and this form is generally accompanied by a more discursive habit. The leading characters of the gargany are: the bill black, the feet dusky-grey, the wing-spots greyish green, bordered with white; a white streak down the side of the neck from the eye; the back and breast purplish brown, marked with crescent-shaped dusky spots; the belly cream colour; the flanks and vent dusky, as are also the quills and tail feathers; the coverts grey with white margins; and the wing spots green, but very inconspicuous in the female, which has the upper part brown with dusky streaks. This bird is, like all the rest, chiefly seen in England during the winter only; and for this reason, though it is called "summer" teal, it is usually described as a winter visitant. In France, where it is more common than in England, it begins to build its nest in the beginning of April, whilst it begins in England a month later than this; so that there is little chance of the same individual birds, being seen in both countries; and thus it is probable that it not only breeds in some parts of the British islands, but in many of them, though no where very abundantly, and always in a very concealed and hiding manner. The pairing cry of the male bears some slight resemblance to that of the corn-crake, only it is harsher, and not nearly so loud, and it ceases before the time at which the other begins. The nest is placed on the ground among thick herbage; and the eggs, which are greenish fawn-colour, are said to be more numerous than the common teal.

BIMACULATED TEAL (*Q. glaucitans*). This species is rather larger than the common teal. Its bill is lead colour, with the margin and nail on the tip black; the feet are of a dull yellowish colour, with the webs dusky; the head, and upper part of the neck, are deep black, with rich reflections of purple and green; and on each side of the head there are two bright

spots of rust colour, one before the eye, and the other behind, and it is from these spots that it gets its common name of bimaeculated, or two-spotted. The prevailing colour is ash, passing into purplish brown, with a wing-spot of bright green, bordered with white, and divided in two by a black bar. This species is very rare indeed, even as a straggler, though it is abundant in the marshes of eastern Europe, and of western and central Asia. Its manners are therefore little known, though it is understood that both it and some other species of teal, which inhabit still further to the south-eastward in Asia, differ so little from those of the teal of western Europe, that a particular description of them is not necessary, at least for popular purposes.

THE AMERICAN SUMMER TEAL, or SUMMER DUCK (*Q. sponsa*). This is one of the most beautiful of the whole family of ducks, of gentle manners, and tamed without much difficulty. It inhabits the warm parts of North America, and many of the West India islands, and remains during the breeding season. Its habits differ from those of the European teal, though these probably depend more on the different nature of the two countries than of any great difference of the birds. The chief habit is, that this one builds very frequently in the hollows of old trees, in consequence of which it is called the wood-duck, while the teal of Europe builds on the ground or among the herbage. There are, however, other instances in nestling on trees in America, while the corresponding species in Europe nestle on the ground. This is a very neat and compact little species, and has been introduced into the Zoological Society's gardens by the late able and enterprising naturalist who met with so dreadful a death in the trap for wild bulls in the Sandwich Islands. These birds have bred readily in the gardens, and there is no doubt that they might be generally introduced into this country. Their chief value, however, would be as ornamental birds on the waters of pleasure-grounds, for their flesh is described as being of very inferior quality. We subjoin Wilson's description of this bird, as it is exceedingly accurate, so much so, that it does not admit of improvement. It is "nineteen inches in length, and two feet four inches in extent; bill red, margined with black; a spot of black lies between the nostrils, reaching nearly to the tip, which is also of the same colour, and furnished with a large hooked nail; irides orange red; front, crown and pendent crest, rich glossy bronze green, ending in violet, elegantly marked with a line of pure white running from the upper mandible over the eye, and with another band of white proceeding from behind the eye, both mingling their long pendent plumes with the green and violet ones, producing a rich effect; cheeks and sides of the upper neck violet; chin, throat, and collar round the neck, pure white, curving up in the form of a crescent nearly to the posterior part of the eye; the white collar is bounded below with black; breast dark violet brown, marked on the fore part with minute triangular spots of white, increasing in size until they spread into the white of the belly; each side of the breast is bounded by a large crescent of white, and that again by a broader one of deep black; sides under the wings thickly and beautifully marked with five undulating parallel lines of black on a ground of yellowish drab; the flanks are ornamented with broad alternate semi-circular bands of black and white; sides of the vent

rich light violet; tail-coverts long, of a hair-like texture at the sides, over which they descend, and of a deep black, glossed with green; back dusky bronze, reflecting green; scapulars black; tail tapering, dark glossy green above, below dusky; primaries dusky, silvery without, tipped with violet blue; secondaries greenish blue, tipped with white; wing-coverts violet blue, tipped with black; vent dusky; legs and feet yellowish red; claws strong and hooked. The female has the head slightly crested; crown dark purple; behind the eye a bar of white; chin and throat, for two inches, also white; head and neck dark drab; breast dusky brown, marked with large triangular spots of white; back dark glossy bronze brown, with some gold and greenish reflections; speculum of the wings nearly the same as in the male, but the fine pencilling of the sides, and the long hair-like tail-coverts, are wanting; the tail is also shorter.

BLUE-WINGED AMERICAN TEAL (*Q. discors*). This inhabits more northerly than the former species, and ranges as far to the north as the valley of the St. Lawrence, if not farther. They return early to the middle and southern states of the American union, and appear in large flocks, which squat on the mud very closely together, so that the sportsmen find them a very profitable description of game. Their flesh is also highly esteemed. They are, to a great extent, vegetable feeders, and greedily consume the seeds of Canada rice, and many other aquatic plants. They are rather small birds, measuring rather more than one foot in length, and rather less than two feet in the stretch of the wings. The front and back of the head are black; a crescent-shaped gorget of white extends from the eyes under the chin; and the rest of the head, and part of the neck, are slate-colour, with rich reflections of green and violet; the lower neck dusky, with bars of pale white; the belly brown, with dusky lines; the sides of the vent pure white, but the lower tail-coverts black; the lesser coverts clear blue, from which the common name is given; the quills dusky, the secondaries black; the wing-spot rich green; the tail pointed, and two inches longer than the closed wings. The female wants the black on the head and the rich reflections on the neck, and is rather smaller in size. These birds are exceedingly abundant in all those places which suit their habits.

The common teal also occurs in America, very little different, either in appearance or manners, from what it is in the eastern continent. It is there called the green-winged teal, to distinguish it from the others, and, as is the case in Europe, it is rarely seen during the summer months.

WIDGEON (*Mareca*). This bird is much larger than the teal, and its flesh also ranks higher in the estimation of epicures. The common species (*M. Penelope*) is twenty inches in length, and about twenty-three ounces in weight, or double that of the common teal. The bill is narrow, about an inch and a half long, of a bluish lead colour, but with a nail on the tip almost black; the crown of the head is cream-colour, passing nearly into white at the base of the bill; the rest of the head and the neck are light bay, the upper part and flanks marked with waving lines of black and white; the coverts of the wings brown and white; the quills dusky; the wing-spots green; the tail-feathers ash colour, except the two middle ones, which are considerably produced, pointed, and of a black colour, as are also the vent

feathers; the legs and feet are nearly the same colour as the bill. The female has the head rusty brown, mottled with black, and the back deep brown, with paler margins to the feathers.

In its general shape the widgeon more resembles the ducks, properly so called, than any of the teal; but the male is subject to considerable variations of colour, by losing his gay tints in the winter. It is understood that the nest of the widgeon, which is very little known, resembles that of the common teal; the eggs also are about the same number, and of a dull greenish grey. In England these birds are most abundant in the southern parts of the country, and they are described as advancing more toward the western shore than any others of the family which make their chief appearance in the winter season. They are very generally distributed over the continent, both in Europe and in Asia, and they range as far south as Egypt. Very little is known of their summer habits in any locality, and therefore it is not improbable that they are resident in many more places than is usually supposed.

There are several other species of fresh-water ducks, having the hind toe free, unincorporated in the membranous web of the foot, but those which we have noticed will afford to the general reader some notion of the leading characters of these birds; and, considering their numbers, and the little that is known about many of them at that season when their history is most interesting, it would neither suit the space to which we are confined, nor the purpose of this work, to enter more at large into the details. We shall therefore proceed with a short catalogue of the leading members of the second division.

II. WITH THE HIND TOE WEBBED. The birds of this division carry us more to the deep waters and the sea than those of the former; and the general form of their bodies, and also the structure of their legs and wings, are all modelled to accord with this habit; the head is thicker, the bill more inclining to pointed, the neck shorter, the wings rounder and more hollow, and the whole plumage more compact, and furnished with closer down among the roots of the feathers. As they are all more of a ranging character than the land, or rather fresh-water ducks, and, generally speaking, inhabit more northerly, they are more under the influence of the seasonal action of the hemispheres, and therefore their migrations have been better observed. There are differences in their haunts when they come southward in the winter season, some proceeding more inland, and others keeping more in the sea or the estuaries; and those which have the latter habit perhaps keep more to the north, even in winter, than those which have the former. It has been thought convenient to subdivide them into several divisions, which may either be considered as genera or sub-genera.

SCOTER (*Oidemia*). These birds are about the size of the common mallard, but they have an enlargement more or less turgid at the base of the upper mandible. Their wings and tails are very close and stiff, and not liable to be injured when they are immersed in the water. They do not come much upon the fresh waters, but keep the shores of the sea, and find great part of their food by diving. Their breeding places are not much known, but it is supposed that they resort far to the northward in the winter. Most of them are common to the northern

shores of both continents, and found in the extreme north during the summer months. Their flesh has a rank and fishy taste, and is inferior to that of any other ducks. In former times, when the use of flesh



Scoter.

was prohibited with great strictness during lent, and in many countries still, the ecclesiastical authorities decided that scoters were a sort of fish, and so might be eaten with impunity on the meagre days and during lent.

THE BLACK SCOTER (*O. nigra*). The plumage of this species is entirely black, without any marking, or even any wing-spot. There is an indistinct knob at the base of the upper mandible, which, together with the streak down the middle of the mandible, is of a reddish yellow, but the rest of the bill is black, without any appearance of a nail at the tip. The orbits of the eyes are yellow, and the irides brown; the tarsi and toes of the feet are dusky, and the webs black. The female is rather less than the male, and the black has a rusty tinge. They frequent the coasts of Britain in considerable numbers during the winter season, and are understood to feed almost exclusively on shelled mollusca, for which they dive in water of considerable depth, so that they are often caught in the nets of the fishermen. Scoters come with the flood tide, and any one who has attended to the economy of nature on the shores will at once see the cause of this. When the tide ebbs, the shelled mollusca shut themselves up, or, where they have that habit, plunge down into the sand or mud; but when the tide returns, they come up and open their shells, and thus they are readily captured by the scoters, which are found numerous and active in proportion as their peculiar food is abundant. This species is found equally in all places of the North Seas.

THE VELVET SCOTER (*O. fusca*) is perhaps not quite so abundant as the black scoter, and the one



Velvet Scoter.

has often been confounded with the other, as they are about the same size, and differ little in their habits. They may, however, be distinguished from each other

without any difficulty. The plumage of the male is velvet black, without any gloss, and there is a crescent-shaped spot of white under each eye, and wing-spots of the same colour. The irides, the tarsi, and the toes, are also reddish; the bill dusky at the base and the margins, but dull yellow in the greater part. The black on the female is not so intense, and the under part of that sex has a whitish tinge. They are also a little larger in size than the black scoter. Their flesh, like that of the former, is rather rank in the flavour, but still it is readily eaten by those northern people who depend chiefly upon the sea for subsistence.

THE SURF SCOTER (*O. perspicilla*). This species is in a great measure confined to the American shores, but is found equally on both sides of the continent, and thus it may be expected in the adjacent part of the north-east of Asia. It migrates with the seasons, and does not appear to differ much in its habits from the other two species, but it is readily distinguished by its markings. Its general colour is black, and there is no spot on the wing, but the nape of the neck, and a band across the eyes, are white; the tarsi and toes are blood-red, and the bill is yellowish-red, with a grey tip, and darker margins, which are more pectinated than in the other scoters. This species may be said to be unknown on the more southerly coasts of Britain, and it is very rare even on the most northerly isles, being seldom seen as any other than a merely straggling specimen, in all probability helped on its way by the north-west gales. It is necessary, however, to speak with caution of what may or may not be present on those rocky and formidable shores, when the north sea is up, and lashing them with all the violence of a wintry tempest, because these are not times at which observations can be made, and therefore there may be many birds which visit those places quite unknown to naturalists.

POCHARD (*Fuligula*). The birds of this sub-genus are much more interesting to those who are fond of water-fowl than the scoters. They are short and dumpy in their forms, but exceedingly well made both for swimming and for diving. When they visit Britain in the winter, they are much more inland or fresh-water ducks than the scoters; and therefore, though their breeding places are not much known, the probability is, that they are the fresh-water marshes and lakes of the polar countries rather than the shores of the sea. There are a good many species that come regularly to the fresh waters of Britain, and also to those places of the estuaries to which we have so often referred as the chief haunts of water-fowls. They are also pretty generally distributed over both continents, though it has not been ascertained that any of them pass the summer far to the south in either continent. They are understood, however, to be much more easily kept in a state of domestication than those diving ducks which are more partial to the sea; and as they are very handsome and lively upon the water, as well as very excellent eating, they are worthy of more attention than they have hitherto received.

THE RED-HEADED POCHARD (*F. ferina*). This duck is common to the two continents; and used in England, where it comes in the winter, to be called the red-headed wigeon. It is, also, from some of its colours, called the "dun bird," by the fowlers and dealers. The weight of this duck is about a pound and three-quarters: its length nineteen inches, and

the extent of its wings about thirty. Its bill is rather broader than that of the wigeon, of a deep lead colour, and with the tip black; the tarsi are also of a red colour, and the irides orange. The head and neck are deep chestnut, the feathers on the top of the head being considerably produced. The lower part of the neck, the breast, and the upper part of the back, are dusky black; the scapulars and coverts next the body greyish white, pencilled with delicate lines of black; the exterior coverts and quills are dusky brown; the belly ash-coloured and brown; and the tail, which is short, and consists of twelve feathers, is of a deep grey, inclining to black. The female has the upper part of the head dusky brown; the remainder of the head and part of the neck pale blackish brown; the breast brownish ash, closely margined with whitish; and the back dark ash with little or no appearance of pencilling. The bill, wings, and feet, are nearly the same as in the male.

This species comes very plentifully to the oozy runs and partially concealed waters of those districts where ducks are caught in so great numbers; and therefore it is plentiful in the London markets, especially in Leadenhall, which is the grand mart for all this race of birds. They are taken in decoys, but not in the same kind of decoys or in the same manner as the mallards, which are the game principally alluded to, in noticing the structure of decoys in a former part of this article. A pond is prepared for the pochards, as well as for the others, and a situation is chosen which shall possess in the most eminent degree the three attractions of quietness, cover, and proximity to the feeding grounds; but this pond does not terminate in pipes with tunnel nets permanently stretched over them. It is technically called a flight pond, because the birds are captured when they are first on the wing; and the nets, by which this is effected, are so placed as that they may act to windward of the birds, as ducks always fly to windward when they take the wing. The net is kept ready extended on the top of the reeds or other cover, upon poles, which by means of a counterpoise at the bottom, can be instantly erected, upon withdrawing the pins, by which they are held down; when this is done, the poles rise and elevate the net to the height of about thirty feet; and this takes place just as the birds are alarmed, and made to take the wing. They strike against the net, are thrown off their balance, and are thrown on the ground, which, all under the net, is formed into little pens or traps, into which the birds fall, and are unable again to take the wing. The numbers caught in this way, at one skilful application of the net, are often perfectly astonishing; and they tumble into the pens one over the other, till the lower ones are killed, and sometimes pressed nearly flat with the burden of their companions. It is mentioned that, on some parts of the Essex coast, a wagon load of pochards have been taken at one drop of the net. This species is common to the two continents, appearing in the temperate climates only during the winter; and resorting to the more northerly ones in the breeding season. It is, properly speaking, a fresh water duck; but it never, in its winter haunts at least, ranges to any great distance from the sea. This, however, is no proof that it does not breed far inland in the marshes; because food is most abundant in those marshes in the summer; while the portions of the rivers next the sea in the rich flat countries, abound most in food during the winter, even in countries

where the inland and upland pools and marshes are not frozen at that season.

CANVASS-BACK POCHARD (*F. valsineria*). This is an American species, very abundant in the States during the season of ducks; by far the most celebrated in that country; and, indeed, according to Wilson's account, which is very minute and circumstantial, it is the most celebrated as an article of food, of all the web-footed birds. It is entirely unknown in the British islands, and also, so far as we are aware, in the whole of the eastern continent. It is thus described by Wilson: "the canvass-back is two feet long, and three feet in extent, and, when in good order, weighs three pounds; the bill is large, rising high in the head, three inches in length, and one inch and three-eighths thick at the base, of a glossy black; eye very small; irides dark red; cheeks and fore part of the head and greater part of the neck, bright glossy reddish chestnut, ending in a broad space of black that covers the upper part of the breast, and spreads round to the back; both scapulars and tertials white, faintly marked with an infinite number of transverse waving lines, or points, as if done with a pencil; whole lower parts of the breast, also the belly white, slightly pencilled in the same manner, scarcely perceptible on the breast, pretty thick towards the vent; wing coverts, grey, with numerous specks, blackish; primaries and secondaries, pale slate, two or three of the latter of which, nearest the body, are finely edged with deep velvety black; the former dusky at the tips; tail very short, pointed, consisting of fourteen feathers of a hoary brown; vent and tail-coverts, black; lining of the wing, white; legs and feet, very pale ash; the latter three inches in width, a circumstance which partly accounts for its great powers of swimming. The female is somewhat less than the male, and weighs three pounds and three-quarters; the crown is blackish brown; breast, as far as the black extends on the male, dull brown, skirted in places with pale drab; back dusky white, crossed with fine waving lines; belly of the same dull white, pencilled like the back; wings, feet, and bill, as in the male; tail-coverts, dusky; vent, white waved with brown. When they are on the shores in the eastern states of America, these birds feed principally upon a succulent, aquatic plant, which abounds very much in many parts of the waters there. They arrive in a very lean condition in October; but as they resort only to those places in which their favourite food is abundant, they soon get very fat. Wilson says—"They are excellent divers, and swim with great speed and agility. They sometimes assemble in such multitudes as to cover several acres of the river, and when they rise suddenly produce a noise resembling thunder. They float about these shoals, diving and tearing up the grass by the roots, which is the only part they eat. They are extremely shy, and can rarely be approached, unless by stratagem. When wounded in the wing, they dive to such prodigious distances, and with such rapidity, continuing it so perseveringly, and with such cunning and active vigour, as almost always to render the pursuit hopeless. From the great demand for these ducks, and the high price they uniformly bring in market, various modes are practised to get within gun-shot of them. The most successful way is said to be decoying them to the shore by means of a dog, while the gunner lies closely concealed in a proper situation. The dog, if properly trained, plays backwards and forwards along the margin of the water,

and the ducks, observing his manœuvres, enticed perhaps by curiosity, gradually approach the shore, until they are sometimes within twenty or thirty yards of the spot where the gunner lies concealed, and from which he rakes them first on the water, and then as they rise. This method is called *tolling them in*. If the ducks seem difficult to decoy, any glaring object, such as a red handkerchief, is fixed round the dog's middle or to his tail; and this rarely fails to attract them. Sometimes, by moonlight, the sportsman directs his skiff towards a flock whose position he had previously ascertained, keeping within the projecting shadow of some wood, bank, or headland, and paddles along so silently, and imperceptibly, as often to approach within fifteen or twenty yards of a flock of many thousands, among whom he generally makes great slaughter." So much are those birds esteemed, that every stratagem which the fowler can invent is had recourse to for the capture of them; and they are so numerous that those employed in this way are generally very successful.

THE SCAUP POCHARD (*F. marila*). This species is also a native of both continents, having nearly the same habits as the others, breeding in the northern marshes, and migrating southward in the winter. It is smaller than the last mentioned, or than the red-headed pochard, being about eighteen inches long and twenty-nine in the stretch of the wings, and weighing rather more than a pound and a half. The colours both of the naked parts and of the plumage are subject to variations at different ages, and also in different individuals. In general the bill is bluish, the feet lead colour, the irides golden yellow, and the wing-spots white. The head, which is tumid, is glossy green half way down the nape, the neck, breast, and lower part of the hind neck black; the back and scapulars white, with waving lines of black; primary quills brownish black; secondaries white with black tips; belly white, marked with black near the vent; vent feathers, rump, and tail coverts black, and tail feathers dusky brown. The female has the front and sides of the head white, the rest of the head brownish, and the general colour inclining more to brown in the male bird. In consequence of this colour of the female, the species is sometimes called the white-faced duck. Their principal food is understood to be small shelled mollusca and aquatic worms; in search of which they range the flat banks in the bays and estuaries; but they are indiscriminate in their feeding, and very easily tamed.

WHITE-EYED POCHARD (*F. nyroca*). This species gets its name from the whiteness of the irides, which give it a peculiar expression. It is about seventeen inches in length, and two pounds weight. Head and all the fore part rust colour, with a collar of darker, and a white spot on the chin. Back and wings black, glossed with purple, and marked with small red spots. Primary quills dusky; secondaries with white bases, and black tips, forming a white and black wing-spot. Tail dusky brown. The female has the head brown, and the back dusky, and without the reflections. This species has the same habits as the other pochards; and, like them, it resorts to the "ducking grounds" during the winter; but it appears to come to England from an eastern migration, and is exceedingly, if not altogether, unknown in Scotland.

TUFTED POCHARD (*F. cristata*). This species gets its name from a crest of about two inches in length, which is pendent from the hind part of the head. It is a

migrant bird like the others, though, probably, it does not range so far; because though not so common in this country as several of the others, it continues longer, chiefly on the fresh waters, and more inland than the other pochards. It is about a foot and a half long, and weighs twenty-six ounces. Bill and legs black; the former broadened toward the tip, and with a black nail; irides dull, yet low: the head, neck, and crest black, but with rich reflections of green and purple. The middle of the back and the breast black, without any reflection; the scapulars and sides mottled black and grey; lower breast and belly pure white; flanks and vent feathers black; tail feathers dusky, wings black, but having a white spot on the secondaries. The female and the young are dusky brown on those places which answer to the white in the male, and they are without any crest.

RED-CRESTED POCHARD (*F. rufina*). This species belongs chiefly or exclusively to the eastern hemisphere, ranging as far as the mountains of central Asia. It is much less known in western Europe; and its appearance in Britain is very rare, and always in the south-east, where a small flock may be seen at long intervals. From what is known of its habits, it appears to be less a sea bird than any other of the pochards. The male is a particularly handsome bird. The bill is red with a white nail, and the feet red with black webs. The nail of the bill is much produced and pointed, and extended over the lower mandible, like a hook. The head and crest, the latter composed of long silky feathers and very handsome, are rich reddish chestnut with purple reflections. The hind part of the head, breast, and middle of the belly, are brown, and the vent feathers black; the back is brownish ash, with two crescent spots of white on the scapulars, which nearly meet. The sides are white, mottled with brown at the margins; the wing spot is also white, and the rump and upper coverts of the tail green with purple reflections. The female has no crest, and the head and upper part are more inclining to brown than in the male.

There are several other varieties of pochards, or, at least, of diving ducks, analogous to them, especially on the northern shores of America, and in some of the Antarctic countries; but too little is known respecting them for their being admitted into a merely popular list.

LONG-TAILED HARELD (*Harelda glacialis*). This species is in many respects analogous to the pochards; it is a diving duck, and makes its appearance at the same season, and it is like them, common to the colder regions of the whole northern hemisphere. It has sometimes been confounded with the pintail, principally, we believe, because both agree in having their tails longer than any other ducks; but still they are different in their habits, and belong to separate divisions. This species has the bill very short, and black, with a transverse red stripe; a large patch of chestnut brown on the sides of the neck. Length from twenty to twenty-one inches, owing to the elongation of the middle tail feathers; but the bird is only about the size of a pigeon. This bird inhabits Europe, Asia, and America; frequenting both the interior lakes and the sea shores of those quarters of the world. The birds of this species do not, like many other of the tribes, entirely quit their northern haunts in winter, but considerable numbers reside permanently in the polar regions. Numerous flocks, however, spread themselves southward in the winter from Greenland

and Hudson's Bay, as far as New York, in America; and from Iceland and Spitzbergen, over Lapland, the Russian dominions, Sweden, Norway, and the northern parts of the British Isles, in Europe. The bands which visit the Orkneys, appear in October, and continue there till April. About sunset they are seen in large companies, going to and returning from the bays, in which they frequently pass the night, making a noise, which, in frosty weather, may be heard at the distance of some miles. They are rather scarce in England, to which they resort only in very hard winters, and even then in small straggling parties. They fly swiftly, but seldom to a great distance, making a loud and singular cry. They are expert divers, and supposed to live chiefly on shell-fish. The female places her nest among the grass, near the water, and like the eider duck, lines it with the fine down of her own body. In the northern parts of the American continent, these ducks are found in vast numbers during the summer; but as they are more marine in their habits than most of the species, they do not move farther to the south in winter, at least in their more numerous masses, than they are compelled to by the freezing up of the shoals and shallows, where they seek their food. Their nests are described as being hid in the grass or other coarse herbage; but never at any very great distance from the sea. On their southward migrations, they seldom resort to the inland marshes, but take short flights from channel to channel in the broken parts of the shores. Their style of flight is rapid, and they utter a singular, and when in numbers, a very loud cry while on the wing. Their flesh is rank in flavour, and little esteemed; and thus they are apt to take their flights and carry on their fishing without being much disturbed.

GARROTS (*Clangula*). These are northern species, found, we believe, most abundantly in the northern parts of the Atlantic, and therefore more plentiful on the shores of America than on those of Europe, even in the winter months, when they quit their polar habitations, or rather are driven from them by the ice. The position of the Scandinavian mountains forms a sort of barrier, excluding the polar birds of the Atlantic from the north of continental Europe; and besides, the waters of the Baltic do not partake of any of the advantages of the Gulf Stream, and the fertility which it brings; and this farther arrests the progress of those birds, which otherwise might be much more abundant in the marshy districts of central Europe during the winter. The general characters of the garrots are: the bill short and narrow; the feathers on the scapulars produced, pointed, and apart from each other; the third quills passing over the primaries in the closed wing, but not being loose and pendent as they are in some birds. They are rather small in size, but very active.

THE GOLDEN EYE, OR COMMON GARROT (*C. vulgaris*). This species is named from the colour of the iris of the eye, which is very brilliant, of a bright yellow colour, and shines like a little spot of gold upon the side of the head. They swim swiftly and beautifully, dive with great expertness, and live upon aquatic animals, including reptiles, and even water mice. On the wing their motion is very swift, but their flight is usually low, and accompanied by a peculiar whistling or clangulous noise. Their breeding places in the eastern continent are little known; but in America they are said to build on the stumps and in the hollows of old trees. The golden eye is about eighteen inches

long, and thirty in the stretch of the wings, and weighs about a pound and three quarters. The bill is of a bluish colour. The upper part of the neck, and the head, the feathers on the top of which are very thick and much produced, forming a sort of crest, but not a pendent one, are of a rich glossy green, with the exception of a white spot just behind the gape. Below the green there is a collar of deep velvet black, below which the whole under part is pure white, with the exception of a few black feathers on the flanks and thighs. The middle of the back and the rump black, and the tail brownish; some of the scapular feathers produced and of a white colour, the rest are black, as are also the tertiary quills, which cross over the primaries. General colour of the wings brownish black, with the coverts and secondaries white crossed on the middle by a black bar. The female is brown on the head and dusky on the back, with paler margins to the feathers. The males do not attain the full colours of their mature plumage until the second year.

HARLEQUIN GARROT (*C. histrionica*). This species is named from the similarly contrasted colours of its coat. The harlequin inhabits the same parts of the world as its congener, the golden eye, but it inhabits more northerly, and does not appear in the low latitudes of either continent in even the severest winters. This does not arise from its being a scarce bird in the high latitudes, but from its polar habits. It is abundant on the shores of the arctic ocean both in America and in Siberia, and also in the islands to the south of Behring's Strait. Indeed, excepting as an occasional straggler, it appears to keep, at all seasons, as near to the polar ice as the water is open. In Britain we believe it has never once appeared in the south, or even on the main land of Scotland, though it may at some times be driven upon those inhospitable shores near Cape Rath, which are not very accessible to observation during the winter storms. It is sometimes seen in the more remote isles of the north, though only a straggler. On the coast of America it is a little more common, because that coast lies nearer to the Arctic countries in which it breeds; but even there it is very rare on the shores of the midland states, and quite unknown on those of the southern.

It is smaller than the golden eye, and much more peculiar in its markings, though that also is a gaily coloured bird. Its length is about seventeen inches, the stretch of its wings about twenty-six, and its weight a pound, or perhaps a little more. The general colour of the upper part of the body is a deep glossy green, which in some lights appears almost black, but in others it throws out brilliant reflections of lighter green and of purple. This green is marked with lines of white and black, very conspicuous and well defined, and placed differently from similar markings on any other birds. On each side of the head there is a curved white line, beginning near the nape, passing over the eye to the gape, and returning on the cheek, where it has a reddish tinge. This white curve is margined on its under side by a very narrow line of intense velvet black, without any reflections, which contrasts strongly with the ground-colour of the head, notwithstanding the deep tint of the green on that. A circular spot of white is placed immediately behind the eye; and from a little behind that, a white line passes from the head down the side of the neck, and another narrow line of white,

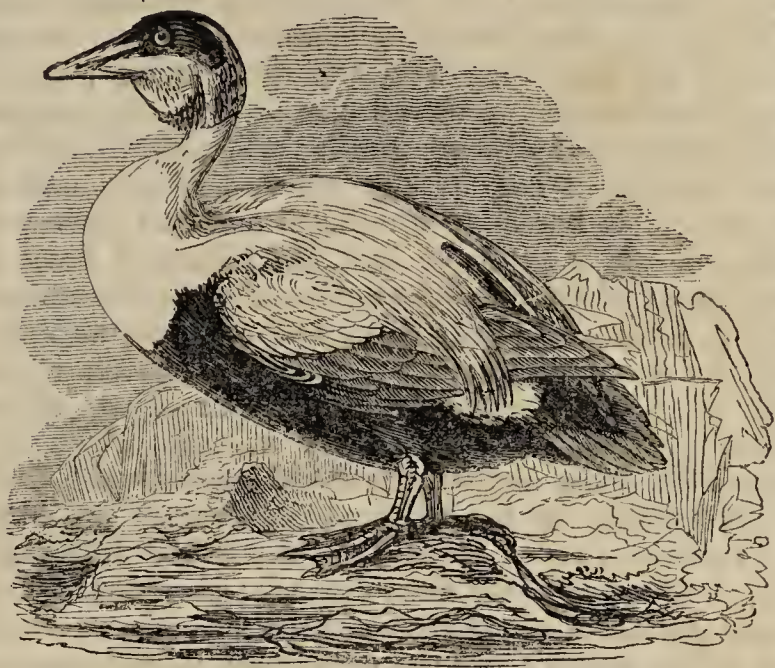
margined by black, almost surrounds the lower neck as a sort of collar. These distinct arches of white, with the convex sides upward, reach from the shoulder to the breast, the one next the shoulder having a black margin on the under side, and the remaining two a similar margin on the upper. These arches form nearly a continuous band, and the portion of the breast which they enclose is of a bluish ash colour, relieved by lighter margins to the feathers. The remainder of the under part is brown, with a tinge of red toward the flanks. The scapular feathers are pretty long, pointed, distinctly separated from each other, of a white colour in the middle, but with black margins. The wings and tail are dusky black, and the wing-spot blue, with purple reflections. The bill is dusky, the feet are bluish, and the irides brown. The female has a rusty tinge on the head and neck, the upper part brownish, and the under part dull white. The nesting-places are said to be in the herbage on the marshy places of the Arctic shores, and also near the pools of fresh water in the same region, but never at any great distance from the sea. If we take the whole race of ducks, in the order of their latitudes from the equator to the pole, the harlequin may be considered as the last, and it certainly is one of the most beautiful. Its flesh is also described as being excellent.

EIDERS (*Somateria*). On a strictly systematic arrangement of the duck family, it is not very easy to determine with perfect satisfaction what should be the place of this highly interesting genus. They are much larger birds than any of the other ducks, being as weighty as the average of the geese. They have also some peculiarities in their structure, and more perhaps in their manners. All the species, for we are acquainted with at least three of them, are remarkable for the immense coating of down by means of which they are protected from the cold; and thus, though they are gentle creatures, and to appearance delicate, they are perhaps more proof against the severity of the northern winter than most of the family. In the southern parts of England they are unknown, but there a few which inhabit the Fern islands on the coast of Northumberland; and there are some also on a few of the small islets in the Firth of Forth. From there, northward, they are not met with, because the shores are not suited to their habits; but in the Orkneys, the Shetland Isles, and some of the more remote places of the Hebrides, they are found in greater numbers. Wherever they are met with, they may be considered as resident birds rather than as wanderers; for, though they take long flights when out of the breeding season, they are understood to return to the same haunts.

It is in the more dreary and inhospitable parts of the north that those birds are found in the greatest numbers, and where they may be said to be quite at home. In Iceland, in the Fern islands, and in other northerly places, they serve many important purposes, and the inhabitants would find their comfort much diminished if they were deprived of the eiders. Their eggs and their flesh serve for food; their skins form under clothing, which is proof against very severe cold; and, without very serious injury to the birds, a vast quantity of the finest down is procured from them every year. So firm and elastic is this down, that the same quantity which can be compressed and concealed between the two hands will serve to stuff a quilt or coverlet, which, while it has hardly the

weight of a feather, has more warmth than the finest blanket. We must, however, shortly notice the species.

COMMON EIDER (*S. mollissima*). This is the best known species; it is the one of which a few specimens are found on the British shores, and also the one which may be said to be domesticated by the northern people, though its domestication costs them no expense, as the birds feed entirely on sea-weed, and other products of that element.



Eider Duck.

The common eider has been known from very remote antiquity, and its manners have been well described by almost all who have written on the natural history of the north. During the summer months they are very abundant on all the isles in the Greenland seas; and they are also met with floating in pairs or solitary at great distances from the land, but in these cases they are usually near the ice. In spring they swim in flocks, and in fine weather one of those flocks is a very beautiful sight. They ride high in the water, their attitudes are elegant, and their motion, though swift, is smooth and gliding, and apparently performed with great ease. They can also make excursions on the wing; and, though they are heavy birds, it has been estimated that they can move along, when they are on their high flight, at the rate of ninety miles an hour, without apparent effort or fatigue.

But it is perhaps when they are on their breeding grounds that their manners are most interesting. The nest is made on the ground, composed of marine plants, and lined with down of exquisite fineness, which the female plucks from her own body. The eggs are usually four, of a pale olive green, and rather longer than those of a common duck. About Iceland the eider duck generally build their nests on small islands not far from the shore, and sometimes even near the dwellings of the natives, who treat them with so much attention and kindness as to render them nearly tame. Two females will sometimes lay their eggs in the same nest, in which case they always agree remarkably well. As long as the female is sitting, the male continues on the water near the shore, but as soon as the young are hatched he leaves them. The mother, however, remains with them a considerable time longer; and it is curious to observe her attention in leading them out of the nest almost as soon as they creep from the eggs. Having conducted them to the water's edge, she takes them

on her back, and swims a few yards with them, when she dives, and leaves them on the surface to take care of themselves; and they are seldom afterwards seen on land. When the natives come to the nest, they carefully remove the female, and take away the superfluous down and eggs. They then replace the mother, and she begins to lay afresh, covering the eggs with new down; and when she can afford no more, the male comes to her assistance, and covers the eggs with his own down, which is white. When the young ones leave the nest, it is once more plundered. The best down and most eggs are got during the first three weeks of their laying; and it has been generally observed that they lay the greatest number of eggs in rainy weather. One female, during the time of laying, usually yields half a pound of down, which, however, is reduced one half after it is cleaned. It is probable that the eiders, at least in very many of their localities, depend upon the current of the Atlantic for their food, and also for the materials for the nests; and that, while this circulating of the ocean waters brings the sporæ or germs of the sea-weed, and also the small animals which are buried in these annually renewed deposits, the drift-grass brought by the same current serves the birds for the materials of their nests, just as the drift-wood serves the people for their domestic purposes. This wood furnishes an abundant supply in places where not a tree grows; and the drift-grass, in like manner, brings a store for the birds to those dreary rocks upon which there is not a particle of land vegetation.

The length of the male eider is about two feet three, and the stretch of the wings about three feet; the head is large, and the bill very peculiar; it is three inches long, and two plates from the side of it extend up the forehead, with feathers between them; the colour of this bill is dull yellow; the top of the head is velvet black, divided posteriorly by a white line on each side; a portion of the side of the head is pea-green, divided by a white patch; the plumage from this part to the throat is very thick, and the feathers appear as if the ends were cut off; the upper part of the neck, back, scapulars, wing-coverts, and sides of the rump, are pure white, the under part black; the tail, and the primary and secondary quills, dusky black; the tertiaries yellowish white, and curving down over the closed wing; the tarsi are short, and of a yellow colour, as are also the toes, but the webs are black. The female is considerably different; it is smaller; the bill does not rise so high on the forehead, and the general colour is dark reddish drab, with lighter blotches, and spots of black, and the under part dusky, mottled with black.

THE KING EIDER (*S. spectabilis*). This species does not come so far southward as the common eider, and therefore its history is less known, though it is probable that some individuals breed in the more remote British islands. It may readily be distinguished both by the bill and the plumage, and is somewhat less than the other. The lateral prolongations of the bill on the forehead are arched, ridged, and furrowed; the colour of the bill and feet is a bright reddish orange, but the terminal parts of the plates toward the forehead are black; the feathers over the eye, at the base of the bill, and partly down the sides of the neck, are bright green, meeting in front, and gradually passing into whitish on the chin, which is marked with an angular bar of black; the top of the head and back of the neck are ash-coloured;

the middle of the back black; the coverts dusky, with a patch of white in the centre; the quills black, and the tertiaries curled over them; the tail, which is short and wedge-shaped, black, as are also the belly and vent, but the lower neck and breast are whitish. The female is smaller, of a brown and dusky colour, has the plates of the bill less conspicuous, and the tertiaries not curled over the wing.

WESTERN EIDER (*S. dispar*). This is an inhabitant of the North Pacific, though it sometimes finds its way to the Atlantic, and, in a solitary instance, has been found in Britain. Bill black, hooked at the tip; ground-colour of the head and neck white, with a green band on the forehead, and another on the nape, and a black collar, and the chin black; upper part black, pied with white, with the tertiaries much produced, and curving gracefully over the wings; under part white forwards, and brown to the rear; feet lead-coloured, large and strong; the whole body elongated, and the head slender.

Such is an outline of the interesting family of the ducks; but it would take much space, and more labour and research, to fill up that outline with the requisite minuteness of detail.

DUCK WEED is the *Lemna* of Linnæus, and that well-known floating plant which forms "the green mantle of the standing pool." It belongs to *Monæcia Diandria*, and to the natural order *Fluviales*. There are four species, all indigenous to Britain.

DULCAMARA is the *Solanum dulcamara* of Linnæus, a common British hedge plant, otherwise called bitter-sweet.

DUMB-CANE is the *Caladium sequinum* of Ventenat, so called from its reputed property of taking away the power of speech, if eaten.

DURANTA (Linnæus). Tropical evergreen shrubs, belonging to *Didynamea Angiospermia*, and to the natural order *Verbenaceæ*. Generic character: calyx tubular, rather truncate, five-lobed; corolla funnel-shaped, tube curved, limb five-lobed, lobes nearly equal, spreading; stamens within the tube; anthers roundish; style filiform; stigma thickened; drupe united to the calyx. This is a pretty genus, and thrives under the ordinary management, flowering freely, and is raised from cuttings.

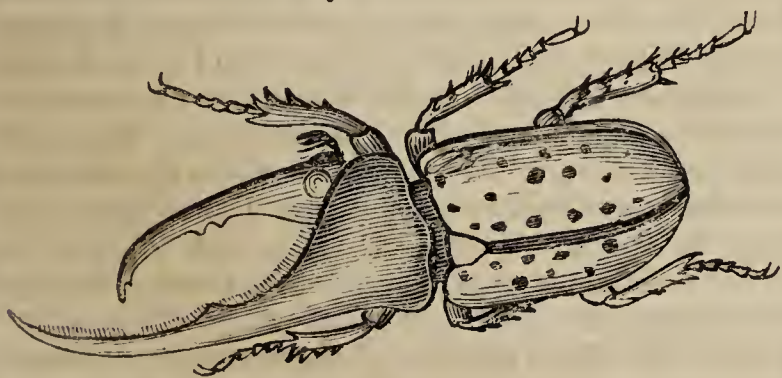
DUVALLIA (Haworth). A genus of succulent plants, natives of the Cape of Good Hope. Linnæan class and order, *Pentandria Digynia*, and natural order, *Asclepiadeæ*. These plants require to be potted in dry sandy soil, mixed with lime rubbish. Very little water is necessary, for if it becomes stagnant about the roots, the plant is apt to rot. They are propagated by cuttings, which should be dried in the sun till the wound is healed, and then placed in dry soil to make roots.

DYNASTES (MacLeay; SCARABÆUS, Linnæus, and of the modern French authors). A genus of coleopterous insects, belonging to the section *Pentamera*, sub-section *Lamellicornes*, and family *Dynastidæ* of MacLeay, in which the body is very large and thick, the outer edge of the jaws sinuated or toothed, and the lower jaws corneous and toothed. This genus comprises the largest and most robust of the insect tribes, and many of the species are armed with remarkable spines upon the head or thorax, which gives them a very formidable appearance. They are, nevertheless, quite harmless in their habits, residing in their early stages on the decaying bark of trees, their larvæ resembling those of the cock-chaffer and

rosch-chaffer. See CETONIDÆ. Other gigantic insects are inhabitants of tropical regions, to whose entomological fauna they impart a very decided appearance. None are found in this country, and only one in France. The larger kinds are found in Guiana, India, &c.; those, however, found in more moderate climates, as in China, in the neighbourhood of Buenos Ayres, &c., are generally of smaller size.

According to M. Lacordaire, whose researches in entomology in South America have been very extensive, the habits of the various species are nearly alike. During the day they conceal themselves in holes in the ground, or on the decaying trunks of trees; or they may occasionally be seen creeping about the footpaths in forests. At the approach of night they quit their retreats, and fly about the trees in the same manner as our *Melolontha vulgaris* and *solstitialis*. M. Lacordaire supposes that it is then that they take their food; but analogy would induce us to suppose that, like the *Melolonthæ*, it is during the day that they feed, and that their nocturnal flights are for the purpose of seeking their mates. They produce a shrill noise by rubbing an elytra against the abdomen. The females are generally more common than the males, and are for the most part destitute of those remarkable horns which the males exhibit, and which, so far as we yet know, seem to be of no use to the insect as means of defence. One of the species, *Dynastes tetyus*, is recorded by Say, the American entomologist, to have occurred on one occasion in such numbers as to have caused no little surprise in the neighbourhood of Philadelphia, where they were discovered, although during eighteen years an industrious collector had only previously met with two individuals. They were found in the cavity of an old cherry tree, which was blown down by the wind.

Of the larger and more remarkable species, the Hercules and Elephant beetles may especially be noticed. The former is black and polished, with greyish elytra, in the males the thorax is protruded into a thick and curved horn bent downwards at the tip, and woolly beneath, being as long as the whole body. The head is also armed with a similar but shorter horn, bent upwards at the tip, so as to come in contact with the former; the entire length of this curious beetle is nearly six inches.



Dynastes Hercules.

The fine species figured for the first time in our plate of "Beetles," from the collection of the Rev. F. W. Hope, F.R.S., is named by that gentleman *Dynastes Hardwickei*, in honour of general Hardwicke, the celebrated Indian naturalist, by whom it was brought from Nepal. It is thus described by Mr. Hope, in his Synopsis of Nepalese Coleoptera, "*Niger, scutellatus, thorace quadricornis, cornu capitis erecto, recurvo, elytris castaneis, pedibusque nigris.*" Black, with a scutellum, the thorax with four rather short horns, the head with an erect horn bent backwards

at the tip, the elytra chestnut coloured, and the legs black. It is rather more than two inches long, and one inch wide.

DYSCHIRIUS (Panzer). A genus, or rather sub-genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and subfamily *Scaritides*. The species are of small size, and closely allied to *Clivina*, from which they differ in having the thorax globose, and the anterior tibiæ not, or but rarely, palmated at the tip. They are of small size, and are found in damp situations, on the sea coast, and under stones, &c.; the species, of which there are nearly a dozen British species, require a more minute investigation than has hitherto been bestowed upon them.

DYSDERA (Latreille). A genus of spiders, belonging to the quadripulmonariæ of Latreille, having six eyes placed in a curve resembling a horse-shoe, open in front, the mouth-claws very large, and produced in front; the maxillæ straight, and dilated at the place of insertion of the palpi. The type is the *Dysdera erythrina* of Latreille, a species not uncommonly met with in England under stones.

DYTICIDÆ. A family of coleopterous insects, belonging to the section *Pentamera*, sub-section *Adephaga*, and comprising the aquatic species of voracious beetles, which formed in the Linnæan system the genus *Dyticus* (or as it is occasionally, but improperly spelt, *Dytiscus*). These insects are distinguished by their oval and depressed form, the moderate length and slenderness of the antennæ, the structure of the legs, formed for swimming, &c. An examination of the external structure of the body of these animals discovers a solidity of organisation of the various parts, from which great strength is necessarily imparted to the insects. A sternum (or breast bone, external), of very large size, of which the parts are so constructed as to form a perfect piece of armour; a pair of flattened coxæ, dilated and produced into a point behind (generally mistaken for the extremities of the sternum itself); posterior legs thick and compressed, and a strong fringe of hairs to all the legs, are the organs which chiefly tend to enable these insects to make their way through an element in which they are the scourge of a mass of animals more weak than themselves. They are, in fact, the aquatic representatives of the equally voracious land *Carabidæ*—all kinds of food seems good to them. They swim with great agility, and often make their way out of the water, not only towards the night, but in the hot sunshine. De Geer kept some a long time in glass vases filled with water, feeding them upon flies and spiders. One day one of them attacked and devoured a large leach, but this food disagreed with it, as the following day large morsels of the animal were discharged from the mouth, and the *Dyticus* soon afterwards paid for its gluttony with its life. Esper kept one of the *Dyticus marginalis* in the same manner, feeding it once a week, or sometimes oftener, with a piece of raw beef the size of a nut, from which it completely sucked the juices. It would sometimes fast for several weeks together. It killed an individual of *Hydrous piceus*, a water beetle larger than itself, piercing it between its head and thorax, the only part of the body not protected by the horny covering of the animal.

This family comprises a great number of species, of which the majority are of small or minute size.—These, of course, have not attracted so much of the attention of observers as the large species, whose

habits and transformations have been recorded. The eggs of the *D. marginalis*, according to Roesel, are hatched ten or twelve days after they are deposited. In four or five days, the larva is nearly half an inch long, when it sheds its skin for the first time. A second moult takes place in about the same time, when the insect has attained twice its former size: when full-grown it is about two inches long. In summer fifteen days is sufficient for it to attain this size, and to pass into the pupa state, and in fifteen or twenty more days the perfect insect is produced.—These larvæ are found in all waters, and when the period of their transformation to the pupa state is arrived, they bury themselves in the earth at the margin of the water in which they are produced, and form an oval cell, in which they are transformed to inactive pupæ.

The mouth of the voracious larvæ is not constructed in the same manner as that of the larvæ of most coleopterous insects; instead of the mandibles being short and fixed near together, they are placed at the sides of the front of the head, being very long, slender, curved, and acute at the tips, having a channel along its surface with a terminal orifice, these hooks are struck into the body of the prey of the larva, and by their assistance it is enabled to suck those fluids for its own support. The respiration of these larvæ is effected by an apparatus placed at the extremity of the body, so that in general it is to be perceived suspended at the surface of the water by means of two hirsute filaments at the tail, between which the two breathing spiracles are to be seen; hence, when the larva rises to the surface of the water, these spiracles are immediately brought into contact with the air, and the ciliæ of these appendages quickly drying, serve as a buoy to retain the larva in this situation, which, however, it is enabled instantly to quit by giving to its body a vermicular motion, and beating the water with its posterior part, the fringe of which serves as an oar. When the larva is full grown, it creeps out of the water, and Lyonnet at this period observed that it possessed the ordinary number of spiracles along the sides of the body, which, of course could not have been previously employed (the animal breathing by its tail as before stated), but which are given to the animal to be employed when it has quitted the water to become a pupa. Lyonnet satisfactorily demonstrated that this was the fact by again placing in the water one of those larvæ, when bubbles of air escaped from each of the breathing pores, a circumstance which had not previously taken place.



A, the larva. B, the perfect *Dyticus marginalis*.

The period of coupling of these insects is during the winter and spring months, after which the female, according to Lyonnet, deposits eggs more than once, each laying consisting of from forty to fifty eggs;

they are deposited without any care in the water, singly, the period of oviposition lasting several days. An idea of the form of the larva and perfect insect will be more readily obtained from the figures which we here give of them than from a detailed description.

The similarity of circumstances in which these insects are placed renders it necessary that they should exhibit but little variation in structure. The number of species is but small, but they are dispersed over a wide extent of country. For instance, a large species of *Cybister* (of which genus, with one exception, the species are extra-European) is found from Senegal to New Holland, being observed at Guinea, the Cape of Good Hope, Madagascar, Mauritius, and the Indian Archipelago. The species of the genus *Dyticus* seem exclusively to inhabit Europe and the north of America, of which latter country the productions in many respects closely approximate those of Europe.

The sexes of these insects exhibit various peculiarities. The elytra of the males are smooth and finely punctured; whereas those of the females, in many of the larger species, have several deep furrows, which are covered with a coating of hairs. The males in some of the latter species have the three basal joints of the tarsi of the fore legs very broad, dilated, convex above, and furnished below with fine hairs. By means of this instrument the male retains its situation during coupling. In the perfect insect the respiratory apparatus does not differ from that of other beetles; but, in order to bring the spiracles into contact with the air, the beetle is obliged from time to time to ascend to the surface of the water, which is easily effected by discontinuing the motions of the feet, when the body, which is lighter than the water, immediately ascends to the surface. In this situation, with the head downwards, and the legs stretched out at right angles, the extremity of the body is pushed above the surface of the water, the elytra are slightly raised at the tips from the upper surface of the abdomen, and a sufficient supply of air is introduced beneath the elytra, which are then closed. If the insects wish to remain beneath the surface of the water with their legs unemployed, they are compelled to lay hold of aquatic plants with their tarsi.

Since the time of Linnæus, numerous generic divisions have been separated from the Linnæan genus; that of *Haliphus*, distinguished by several remarkable peculiarities, having been first established by Latreille, Clairville, Leach, and other entomologists, have added to their number. The genera of which the family is at present composed are, *Haliphus*, *Cnemidotus*, *Pælobius*, *Anisomera*, *Hyphydrus*, *Hygrotus*, *Hydroporus*, *Noterus*, *Hydrocanthus*, *Coplotomus*, *Laccophilus*, *Agabus*, *Colymbetes* (with numerous subgenera), *Cybister*, *Acilius*, *Hydaticus*, *Dyticus*, *Leionotus*, and *Eunectes*; the majority of which comprise species inhabitants of this country.

The typical genus, *Dyticus*, as now restricted, comprises the largest species in the family, the anterior tarsi of which are dilated in the males, the elytra of the females furrowed; the posterior tibiae are of moderate size, and the claws didactyle. There are eight or nine British species, of which the most abundant is the *Dyticus marginalis* of Linnæus, of an olive-black colour; the margins of the thorax and elytra ochreous, with an obscure lunula of yellow near the extremity of the latter. It varies from one to seventeen inches in length.

EAGLE (*Aquila*). A genus of accipitres or rapacious birds, belonging to the division of diurnal preys, and included in the great genus *Falco* of the older naturalists. But their characters are not only sufficient for ranking them as a separate genus, but might in strict system warrant the separation of them into two or more genera or subgenera, at least if the classification were to be made very minutely characteristic of their habits. This part of the subject is, however, foreign to our plan; and as their relation to the rest of the rapacious birds, and some of their structural peculiarities have been noticed in the articles ACCIPITRES, AQUILA, and BIRD, we may restrict this article to the peculiarities of the leading species, of which we shall endeavour to give a popular account, as brief, but at the same time as comprehensive as our limits will admit.

The eagle among birds, like the lion among beasts, has long got credit for qualities which it does not possess, and which it could not possess without a direct violation of the system and purpose of nature. As the lion was named and described as the king of beasts, the monarch of the forest and the wild, so the eagle was elevated to the government of the sky, and made the queen, or rather (for they gave to the male that superiority which really belongs to the female) the king of the feathered race. Not only this, but as the eagle is capable of soaring aloft, it was made the companion of the Gods, the constant associate of Jupiter himself, and in some sort the emblem of his power; and now that Jupiter has gone the way of all idols, and the eagle still remains in localities which generally have a great deal of wild grandeur and rude sublimity about them, the eagle has become the monument of her fabled master, and is still "the bird of Jove."

In so far as natural history is concerned, those fables are as absurd as they are difficult to be got rid of by those who are fond of romancing; but they have their use in throwing light upon the feelings of men in the more rude and early stages of human society. The eagle, like the lion, was gratuitously endowed with a great many virtues, being set down as the most courageous, the most noble-minded, and the most generous of birds,—as one in short who could do nothing at all calculated to lessen the majesty of a monarch. Whereas, in fact, unless in so far as that instinct which has been given them in order that they might answer these appointed purposes in wild nature, prompts them to kill and eat, eagles are not only indolent, but they are, in reality, cowardly birds; that is, when their purpose is accomplished, they seek retirement, and relapse into a state of perfect inaction. That they must have done so in the early stages of their history, the same as at the present time, does not admit of any doubt; for how much soever the dispositions and opinions of men may improve, or fall off in the course of those fluctuations, with the accounts of which the annals of the race are chequered, the other animals have no opinions, and partake not either of the improvement or of the falling off, in consequence of any direct influence of the human race, in one way or another. It is, no doubt true, that when society improves, and extends its arts and its cultivation, so as to require protection to cultivated vegetables from those animals upon which the predatory tribes feed, and protection to those domesticated animals on which the others would feed, the predatory races fall off in numbers,

and ultimately become extinct, before the progress of human art.

This fact, and any one who attends to the evidence, will be able to discover that it really belongs to the system of nature, and is not brought about by human exertions in exterminating the animals, though this may in many cases assist, is sufficient to convince any one that there is really an opposition between those destroying animals and man, viewing him even simply in the light of a consumer of the fruits of the earth,—that, when man is not there, and nature is yet bountiful in consequence of the elements of fertility abounding in any place, those powerful animals, whether they prey upon the earth, in the air, or in the waters, are an essential part of the exuberance of wild nature, and have important functions to perform in its economy. If we may so express it, when the locality is of that generous and bountiful character, in which it would best reward the labours of the cultivators, but is yet without the cultivator to earn and to enjoy the reward, the lion, the eagle, the wolf, or whatever may be the predatory animal whose structure and habits are best adapted to the place, is really in the character of *locum tenens* for man; and in this respect it may be considered as the keeper of wild nature for man, until he shall have arrived at the majority of knowledge and of art, and shall be able to take the government on his own shoulders, and prevent the bounty of nature from being lost, at the same time that he makes his own advances in intelligence and enjoyment.

Such being the case, all attributing to animals of any disposition in any way analogous either to any virtue or to any vice of man, and all attributing to them of any plan or purpose, or any combining together, for the weal or the woe of each other, according to any forethought plan, is an error in principle, tending to jumble together the conduct of irrational and irresponsible creatures, and the conduct of rational and responsible man: and thus, not only destroying the philosophy of both in a natural history point of view, but laying a sure foundation for scepticism and doubt, by shaking man's belief in the existence of his immortal spirit and thereby laying the axe to the root of all sound morality, all conduct upon principle, and all hope that the mental acquirements, which man obtains in this life shall not be lost, and buried with him in the grave for ever.

The extent of mischief which has been done by publishing those groundless analogies between the irrational animals and the human race, is incalculable; and, unfortunately, this mischief is not confined to those who, in the waywardness of a wandering philosophy, or in the dread of future punishment, which they seem conscious that they deserve, attack the hopes of immortality avowedly, or with the purpose proclaimed in the preceding view, how much soever the parties may strive to hide it. Were it confined to these, its pernicious effects would be within a compass comparatively narrow; and the avowment or even the implication of such a purpose, would destroy the bad effect; because the world would see that such arguers had motives and grounds which they concealed, and did not fully and fairly examine the whole state of things, and draw their conclusions, and form their judgments from this examination. When, however, the general tone, and even the avowed purpose is to maintain the doctrines upon which these false analogies are calculated to cast doubt, the doubt so

produced is of a much more inveterate and dangerous character. This is, in fact, exactly a parallel to a case which breaks down in the hands of an advocate who is at once able and willing; and the public, who are the jury in this case, are sure to come to the same decisions on its merits, as the empaneled jury do on those of the other,—that the case has no foundation.

This is not only incidental to the natural history of any one species, genus, or class of animals; but it is of so much more importance to the real happiness of men than any thing connected with the details of natural history, that we should not feel our duty discharged, if we did not allude to it upon those occasions where the imputation of modes and motives of action similar to those of man, have been most frequently and generally imputed to the other animals. The kingship which has been given to eagles, or rather the supposed noble and honourable qualities which they have been said to possess, in consequence of this imaginary kingship, are of some use in throwing light upon the progressive natural history of man himself. The only attributes which could be observed in these animals, are great strength or power, when the necessities of the individual animal render it necessary. Other than this, there could be nothing actually observed, for other than this there is nothing to observe; and the additional and nobler qualities gratuitously given must have been given in consequence of a disposition in men in a rude state to attribute every virtue to those who were powerful enough to destroy even though the power was used for working destruction in the most cruel and atrocious manner. Therefore, those royal animals throw some light upon the characters of the kings of early history, from their resemblance to whom they got their titles to royalty; and as we have the animals still unchanged, we can, perhaps, better arrive at the general characters of those early rulers by this means than by any other.

In this, we must admit, there is at least some advantage to be derived, from the fact of human qualities and dispositions having been attributed to animals; for those qualities and dispositions could have been attributed only from the circumstance of a felt analogy between the simple action of the parties compared, at a time when the difference between acting by reason and purpose, and acting by instinct, was but imperfectly understood. Such being the case, whenever we are put in possession of the disposition and character which were imputed to the animal, and then find by observation what the real character of the animal in a state of nature is; we can take the latter as a constant quantity, as the same in the same race, at all stages of the world's history;—and from this invariable standard, we can discover what must have been the sentiments of the people who imputed the qualities, in regard to the moral nature of human actions; and in this way, the study of animals, compared with the ancient opinions of them would tell us far more of the characters of the nations of antiquity than are handed down to us even by the most correct and philosophical historians of the human race. This is an use to which the study of animated nature has not hitherto been applied, although it is a very valuable one. At the same time, however, it is one which cannot be prosecuted with accuracy and success, unless we abandon as entirely fabulous or imaginary all analogy of kind between man and the animals. There is no doubt, however, that this study would repay with information, equally correct and curious, and at the

same time highly valuable as an auxiliary in the study of the human race, the labour of any one who would enter upon it with the requisite degree of knowledge, and work it out with due patience and impartiality.

As it is new, we shall just mention two instances, which may be taken as counterparts, of the noble qualities which were so long ascribed by every body to the lion and the eagle, and which are still in common circulation, and no doubt extensively credited by those whose knowledge of natural history extends no further than having read some of the books of mere description. The ass and the goose are, by universal consent, made the very emblems of stupidity and folly; so much so, that their very names have become so closely linked with these unhappy conditions that to apply any of them to a man would be considered a violation of the rules of ordinary politeness, even in society of not the most scrupulous description. But the ass, so far from being a stupid animal, is a wonderfully sagacious one; and though in this country, where it is abandoned to the least reputable part of society, and badly fed, and worse treated, it is a comparatively slow and sometimes a sullen animal, yet there is not perhaps one of the domesticated mammalia which is so totally free from vice. It is the most enduring, the most patient, the most hard-working, the most temperate, and the most inoffensive of all animals; and as these qualities have not been destroyed, even by cruel neglect and even by more cruel treatment, we must conclude that they are natural to the animal, that they form its disposition as a race, and that they were its observed qualities at the time when its name became the synonyme for stupidity. Now, if any one will consider this list of qualities, and reflect what the moral condition of mankind must have been when these were held as being expressive of stupidity, which all mankind dislike in the application to themselves, a conclusion will be arrived at not very favourable to society, because the opposite qualities, turbulence, wrangling, and all the worst passions and their worst effects, must at that time have been accounted the signs of wisdom. The case of the goose is nearly similar. The goose is a vegetable feeder, and attacks no animal, however weak, though it defends its young with some resolution; and the goose, so far from being a stupid animal, is perhaps the most intelligent and the most susceptible of sensation in the whole poultry yard. This is not the place for entering upon details; but there are many instances recorded of more attachment on the part of this bird than of almost any other of the feathered race. The sum of its character may be said to be mildness; and when, in consequence of this character, its name became a synonyme for folly, it requires no argument or investigation to discover what qualities and what conduct must have been held in the highest estimation among the human race.

We have deemed it necessary to premise these few observations in order that, by detaching them from all fancied analogy to man, we might be enabled to view the eagles in their own natural character, and as a most interesting and in some respects a most wonderful branch of animated nature. When we view them in this respect, they become as instructive as they are delusive while mixed up with man; and thus, by freeing ourselves from absurdity and error, we clear the ground for an instructive perusal of one of the most striking pages in nature's volume; and we may add that there are many bright pages in that

volume which we close to our own view by absurdities of the same class with those of which we have been endeavouring to point out the impropriety and mischievous effects.

The great distinction between the eagles and all other birds of prey, overlooking the differences in particular parts of their structure, is the possession of superior strength, together with superior power of endurance. Some of the vultures are probably birds of larger dimensions than the most formidable of the eagles; and no eagle can be compared with the superior falcons, either in elegance of form or in power of wing; but there is a degree of strength for short efforts, about the eagles, which places them in nearly the same relation to the falcons as the lion and the tiger stand in to those predatory mammalia which run down their game by swiftness of foot. There is nothing in the action of an eagle at all comparable to the beautiful gliding of the kite, the rapid forward flight of the peregrine, or the lightning rush of the jer-falcon. But still the eagle in the air is a splendid bird, and one knows hardly whether most to admire, the terrible stoop of those species which descend from the top of the sky in the open wastes, to strike their prey upon the ground, or of those which descend upon the surface of the waters for the capture of fish. In all the species, the rush of the eagle is of comparatively short duration, for though some of them are described as giving chase on the wing, and striking their prey in the air, yet these are habits of falcons and hawks rather than of eagles. Eagles are, however, found in so many and such different localities in wild nature, that there are great differences of habit in those which are found in different places. The mountaineer, which inhabits the pinnacles of the rocks, nestles on the most inaccessible ledges, beats the upper valleys and moors for prey, preys only or chiefly on living animals, and strikes them on the ground, aided by an impetus obtained by a rush of many fathoms through the sky, in which the specific gravity of the bird aids the descent of the wing, ought perhaps to be considered as the typical eagle. There are, however, some of the most powerful ones which inhabit the forests of the warmer regions, or rather perhaps the margins of those forests; and they unite in so far the habits both of the vulture and the hawk with those of the species which we are disposed to regard as the typical eagle. It is probable, also, that when the hawking action of giving chase on the wing, and the vulture propensity of eating carrion, are joined with the more single predatory habit of the typical species, there is also joined less or more of the disposition to feed upon fish. It is probable, also, that the typical eagle depends more upon the eye in finding her prey than is the case with any of those of mixed habit; and it is worthy of remark that this most typical of the race is confined to the wildest and the barest pastures,—the more lofty mountains in Scotland, perhaps some spots in Ireland, the rocky elevations which mark the forests of Scandinavia, and the elevated wild and bleak districts of the Alps and the Pyrenees. On the other hand, those species which are found on the margins of the tropical forests, however powerful they may be, and however active in the finding of their prey, have an apparent softness about them, even when in a state of the most powerful excitement, which this eagle of the mountain rocks never displays, even though in a state of repose. Nor is there any doubt

that though some of these are of greater size and armed with larger beaks and talons, there is no eagle of the mixed character which would be able to contend in single contact with the golden eagle of the wild mountains of Europe. It is not in the size of the animal, or the form of the instrument, that the superior power resides, it is in the spirit and the muscular energy; and when these are great, they tell in the whole character and expression, and in the case of birds, even in the very plumage. Any one who has an opportunity, and this opportunity may be had in the gardens of the London Zoological Society, of comparing together, the harpy eagle of central America and the golden eagle of Europe, will have no difficulty in perceiving that, though the former is the larger bird, and also has the beak and the claws most formidable, yet that there is a fire in the eye, and a firmness in the whole structure and air of the latter, which leaves not the smallest doubt as to which would be the victor, in the event of each bringing the whole of its strength against the other upon equal terms. Nor is it difficult, from the different modes in which the two must find their food, to see that this is a wise adaptation in nature. The mountain eagle has to contend with all the violence of the mountain storm, while she sits upon the pinnacle of the rock, beaten by the wind and pelted by the snow. Her common flight in ranging for her prey is not rapid or performed with effort; and from the loftiness of her flight, the keenness of her eye, and the few objects which there are to intercept her vision, her floating is neither long nor laborious. When her effort comes, however, it is an extreme one; and, therefore, whether she has to maintain her position against the violence of the elements, or descend upon her victim with that rapidity which makes the viewless air appear to shiver for fathoms in the rear of her, her muscular exertions must be greater than even that which is required for the spring of the lion or the tiger. The other eagle, from the more rich and more sheltered pasture, from having to beat about where trees break her horizon; to catch the larger birds on the wing, and to seize monkeys and other tree animals while they are on the branches, requires a frame, not so knit and wound up for the single effort, but one which is more flexible, and can more readily accommodate itself to the varied circumstances of a chequered scene.

The characters of the eagle are:—The bill very strong, straight in the basal part, and curved only toward the point; the feet very strong, supplied with powerful muscles, and in the mountain eagles always feathered on the tarsi. The toes very stout; and the claws powerful and very much arched. The particular form of the foot and toe varies a good deal with the habits of the birds. If the habit is to kill the prey only or chiefly on the ground, the outer toe is not reversible, though, even in them, it turns outwards until it is at right angles to the axis of the body. In these the under sides of the claws are grooved, so as to form two trenchant or cutting edges upon each claw, which tear or lacerate while the strong muscles are drawing the toes together with great force. When the foot is of this structure, it is the sole instrument employed in killing the prey; and the beak is reserved for rending it after it has been killed. If, on the other hand, the habit is chiefly or exclusively a fishing one, the outer toe is reversible, and the claws want the groove, and are rounded on the under sides. If, again, some of the disposition of the hawk is mingled, the

claws are sharper at their points, and the bill is more arched at the base. In fact, there is a great deal of nicety in the adaptation of the weapons of these birds to the nature of their prey, and the mode of their catching and killing it; but all the varieties of this adaptation would require a very intimate knowledge of the habits of the birds—more, indeed, than it is possible to obtain, from the wild nature of the general haunts of these birds, and the short time that any one of them can be seen in a state of nature.—The wings of eagles are, generally speaking, very long, though less so in proportion to the weight of the birds than in some others of the order. They are remarkably broad and firm. The fourth and fifth quills are the longest; and the third, second, and first get gradually shorter, which gives roundness, but at the same time firmness to the extremity of the wing. The shafts and tubes of the quills, and even the webs are much firmer than in any other birds, and this firmness extends in a great measure to the whole of the plumage, so that no force of the wind, or even any ordinary contact with sprays and twigs, or even conflict on the ground with the more powerful prey, can very much ruffle the plumage of an eagle. In the species which fish, and which have to plunge into the water in the seizing of their prey, and sometimes when that prey is heavy, to struggle with it on the surface, the plumage on the under part of the body, and the under sides of the wings, is very close and compact, bearing no inconsiderable resemblance to that of water birds.

The power of enduring hunger is as remarkable in the eagles as any of their other powers, notwithstanding the boldness with which they prey, and the rapacity with which they feed. The one habit is as necessary to them as the other; for, with the exception of those which depend on the sea, which knows no scarcity except when it is sealed up by the frost, there are seasons at which all of them find but little food on their pastures. Upon the mountain tops there are few animals during the depth of the snowy season, and of the few that are there, hardly any come abroad. It is probable that, at those times, the eagles doze in their eyries without any action, and consequently with very little waste of the system; for it does not appear that mountain eagles come far down from their airy heights even at these times of the year; at the same time, the bones of a perished eagle are rarely found when the season turns, and the snow clears off. They appear, indeed, to be but little migratory at any season. They choose their ground, and, having once chosen it, they keep it; nor does it appear that they are much in the habit of invading the territories of each other.

They all live in pairs, which are never at any great distance from each other, though it is said that, when one of the pair meets with any casualty, the other one wanders off, never to return to the same locality, though a second pair may take possession of the deserted eyerie. The pairs inhabit more or less wide of each other, according to the nature of the pasture, but they are never very near neighbours; nor does it appear that they have any social instinct save that which keeps the pair together, and it is merely the instinct of continuing the race, and nothing more. The attachment to the young, the industry of the old birds in feeding them, and the determination with which both defend them, are all very great; but their apparent paternal attachments and labours are

nothing but results of the same lasting instinct, only as long as the young are helpless, and not only ceasing, but turning to the opposite propensities as soon as the young have acquired sufficient wing and strength for finding their own food. There is a moral, or, at all events, a physiological lesson, that may be drawn from this. The *storge* in the human race is an animal principle as well as it is in eagles; and hence we find it very strong in parents, who are, at the same time, not only neglecting to take those steps which would ensure the mental and moral worth, and consequently future respectability of their children, but following habitually those courses which tend, of necessity, to the very opposite results. This is most conspicuous on the part of ill-educated mothers, who may be often seen pawing and fondling their children, as a tigress paws and fondles her cubs, while she is not only neglecting their minds, but thwarting the father in all his efforts to provide for them. We mention the mother, because there is little or none of this merely animal *storge* in the other sex, as is proved by the total neglect of young children by the males among savages. The moral of the whole is, that the principle, or the instinct, does not carry the human female to perfection, while it invariably does the female eagle. She never slackens her attention till her offspring are fit for the world, while, notwithstanding the strength of the animal impulse, the woman who acts upon impulse alone unfits her offspring for the world by the whole tenor of her conduct. The reader will see that out of this arises a very powerful argument for the existence of mind, and one equally powerful for the necessity of moral as well as technical education. Such is one of the lessons we may learn at the eyrie of the eagle.

When the young eagles are driven off from the parental eyrie, it is not known whether they are yet in possession of the pairing instinct, or at what age they pair. That most of them do pair before they undergo their last change of plumage is highly probable, and this is one of the reasons why one species of eagle has in so many instances been multiplied into two. Even now, it is by no means made out how many of these differently coloured eagles, which are met with in the same locality, are of different species, and how many are exactly the same; and very few years have elapsed since the daughter of the golden eagle of our own country was invariably set down in the books as a different species from the mother.

The systematic natural history of eagles is thus a matter of great difficulty and much uncertainty; and when we attempt to get at their manners, so as to classify them according to these, we are not in a much more hopeful predicament. Every body knows the name, and there are many who have opportunities of seeing the birds, not only stuffed in glass cases but alive in cages; but these convey very little information on that part respecting which information is the most desirable—the manners of eagles in free nature; and he who could procure materials for one year's history of a wild eagle would merit the thanks of every lover of birds.

It is generally understood that eagles live to a very great age, Klein says to not less than four hundred years, though, of course, nobody ever kept a journal of the transactions of an eagle for anything like that period. Instances are quoted, however, of eagles having lived for long periods in a state of con-

finement ; and there is a spot on one of the southern slopes of the Grampians, in Scotland, where the population, that is, the race of people, has not been changed for many centuries, and there a pair of eagles continue to build in a lofty and inaccessible crag, which, according to the concurrent testimony of the people, the same pair have inhabited beyond the period of human tradition, which, in reference to that very crag, is as old as the days of Sir William Wallace, which may be estimated at about the year 1300, or 535 years ago. Whether the eagles were there in the days of Sir William, it is not easy to say ; but if they were, it is probable that the patriotic knight might have caused them some temporary alarm ; for the tradition, universally believed in the district, states, that he descended the face of the crag, nearly perpendicular, and at least a thousand feet high, alighted safely at the bottom, stormed, single-handed, a neighbouring fortalice, then held by the invading English, put the whole garrison to the sword, rallied the country people, led them down Glen Esk, whetted his sword anew upon a great stone by the road-side, met the English army some ten miles down, and totally defeated it, all within the compass of the same four-and-twenty hours. A hint was indeed thrown out, in supplement, by the narrator of this adventure, with whom the writer of the present article went to visit this same pair of eagles as nearly as possible, that the royal birds came there along with Sir William, having scented, by anticipation, the feast of the slain that was to ensue, and that they have remained there in honour of the feast, and in gratitude to the illustrious cause ; but the reciter had the candour to add, that he knew few who believed this part of the narration, and could not really find in his heart to believe it himself. Be that as it may, it is certain that this pair of eagles have been there for a very long period, for the people are both observant and intelligent. Their little glen is quite secluded, and depends on its own productions and occurrences for topics of conversation, and every thing that has happened for a century or two is borne in perfect memory. There is another circumstance. Those ancient eagles of Wallace's Crag were much paler in the colour than most of those which I (that pronoun may be used once) have seen in the same mountains ; and, while it is the habit of the species to lose some white in its progress to maturity, it is also understood to become hoary, through old age, before it ceases to spread its broad wings in the upper air, and to shoot down in its stoop, like a frost-rent fragment from the beetling summit of the crag.

The four distinctive kinds of eagles into which the whole race might be arranged, if we had sufficient data for the determining of all their characters, which, unfortunately for this very interesting branch of ornithology, we have not, would be *Eagles*, *par excellence*, meaning thereby the golden eagle, and the rest of the more powerful mountaineers which agree most closely with it in habit ; *Vulture Eagles*, or those which are more in the vicinity of the woods, and which, though large in size, are not so compactly built, or proportionately so strong ; *Fishing Eagles*, or those which chiefly or partially levy their contributions upon the waters ; and *Hawk Eagles*, or those of smaller size, and comparatively feebler powers. We shall not, however, attempt to make any systematic arrangement of the eagles into these groups, because the characters of many, indeed the greater

number of them, are too imperfectly known for enabling us to make such an arrangement anything like perfect ; and so we must content ourselves with notices of the leading species in an order which is of necessity somewhat miscellaneous.

GOLDEN EAGLE (*A. chrysaëta*). Some notion may be formed of the appearance and expression of this magnificent bird by examining the figure in the plate, "BIRDS OF PREY." That figure represents the eagle in the act of clutching, with the gripe of death, the prey upon which she has just alighted in her terrible stoop from the top of the sky. The aim which she takes on these occasions is so unerring, her descent so rapid, and her stroke so powerful, that if the prey is not a very large animal, the death-wound is given by the shock. It seldom happens, however, that the life of the prey becomes extinct in the instant ; and as the bird never touches the prey with her beak, or even deigns to look at it after the stroke, until all motion of life in it has ceased to the feeling which she has of it with her feet, that where she can be seen in the act of preying, which is not often, even in those countries where eagles are most numerous, she is found to remain for some time in the attitude represented by the artist. During the whole of this time all her weight is borne upon the feet, and all her energy concentrated in the clutch of the talons. The head is elevated and drawn backward in what one would be disposed to call an attitude of disdain, though in reality it is nothing more than the bearing of that part, so as that the whole weight may tell upon the foot or feet engaged in completing the work of death. The wings are held half expanded and shivering, and the tail is spread to the full width of its fan-like expansion. When all motion in the prey has ceased, preparation is made for the feast, unless the prey is to be borne off to the eyrie, which is generally the case when there are eaglets there ; if not, and if the bird is not disturbed, it is done on the spot, and the process is gone about in a very systematic manner. If one of those mammalia on which eagles feed, as a lamb or a mountain hare—but it is rarely the former, as eagles do not hover much over places where there are shepherds and flocks—one foot is planted on the throat, and the other on the lower part of the pelvis, and a stroke of the bill serves to divide the skin along the whole of the under part. The skin is then dexterously turned back on both sides, and the chest and abdomen are opened, the blood and vital parts being the first that are devoured. Then follow the rest ; and if the eagle is hungry, which is generally the case, as nothing but the craving of appetite, or the instinct of feeding the young, can overcome the native indolence of these birds, the whole of the flesh, usually bones and all, is devoured upon the spot. How the golden eagle may deal with feathered prey, the writer of this article is unable to say, never having seen her at such a meal in a state of wild nature ; but, as she goes so well to work in skinning mammalia, there is little doubt that she is equally dexterous in the depuration of birds.

Here it may not be amiss to mention an error with regard to both birds and beasts of prey, which is so very prevalent as to have become an idiomatic part of almost every language, to the users of which such animals are known, and who have advanced so far in the use of thought and of speech, as to have figurative as well as literal meanings to their words. Those more powerful of the carnivorous races, whether of

mammalia or birds, are represented as though they were constantly engaged in the work of death and destruction ; that the lion in the desert is for ever roaring and rending ; and that the mountain air can never rest for the wing of the eagle ; that her shadow is a constant ensign of dread, and her cry a never-ceasing sound of fear. This is the general notion, but nothing can be wider of the fact, and nothing would be more in opposition to the whole tenor of nature's economy. It is the small powers and the feeble exertions in nature that are never at rest. Those creeping currents of the air which we can hardly call breezes, and which tell only upon the leaves of the aspen, are never at rest ; but storms are not frequent, and a hurricane, even in what may be called the hurricane countries, is an event of comparatively rare occurrence. Just so among birds. The sparrow is necessarily catching caterpillars, and picking up those crumbs and that refuse and waste which would become offensive if allowed to accumulate, while, on the average of the year, the golden eagle does not feed once a-day, and probably not once in the course of the week. Even when eagles are on the hunt, they do not occasion much general alarm to those animals upon which they prey. The eagle, when "towering in her pride of place," certainly commands in vision, and can command in power of destruction, a very wide horizon ; but still her command, even at this time, is one of peace and general safety ; and as hawks and buzzards and harriers, which are really far more destructive, especially of moor game, than eagles, are not very fond of beating the bushes if there is an eagle above them in the sky, it is doubtful whether, upon the whole, the golden eagle may not partake more of the character of a preserver than of that of a destroyer. Even when she has singled out her prey, and is about to stoop at it, the fluttering wings, as she winds herself up to the bent of her power, and the loud note with which she begins her descent, all tend to warn the rest of the animals, so that they lie close ; the eagle devours the prey in silence, and she does not stoop again on the same ground during the same day. The consideration of these points is of some consequence in those places where the remains of this truly splendid race of birds are still to be found ; and, as an eagle upon a mountain rock, or in the mountain sky, is certainly worth something, it would be a matter of at least some importance to ascertain whether the evil of them so far overbalances the good, as to warrant a price being set upon their heads, or rather upon their feet, in most places where there is a vestige of them left, and sheep have been introduced.

So far as our personal experience goes—and we have seen a good deal of those places in our own country where the golden eagle is still to be met with in straggling pairs, inhabiting some of the more wild and rocky places—our judgment, founded upon this experience, is in favour of the eagle. Even if these birds did occasionally capture a lamb, or descend upon a sheep that had stuck fast in the mire, and must have perished there, eagle or no eagle, there are surely other pleasures for mankind besides the mere fact of eating sheep ! and as these birds never invade those places of which man has properly taken real and practical possession by cultivating them, it is not easy to see upon what well-grounded plea, either in nature or in the economy of art, man should invade the eagle's country in the not very reputable character of a merely wanton destroyer. It really does not

appear that man has established any title to seek and destroy the eagle upon the ledge of the mountain rock, unless he has built his own dwelling there ; and if he so builds, the eagle will confess the superiority of this his legitimate title, and go away of her own accord ; but, till then, it really appears that there is a natural right on the part of the eagle, and that to disturb her is wanton cruelty, and manifest injustice.

We strongly suspect too, that the "informations" laid against the eagles come chiefly, if not solely, from that most fertile of all sources of error and absurdity, "book-learning." The stories about eagles which are repeated again and again, are, no doubt, terrible enough, and likely enough to mislead and prejudice the minds of the ignorant ; but they are not the more likely to be true upon this account, and by far the greater number of them bear internal evidence that neither the manufacturers nor any of the successive retail dealers knew any thing about the habits of eagles, or had ever by chance seen one in wild nature, nor could they, had they seen one in the sky, have distinguished it from a heron, or even a wild-goose.

We have discussed the subject of the mischief done by eagles with very intelligent sheep farmers in the neighbourhood of their eyries, that is, as near as a house or habitation can be to a golden eagle's nest ; and though the general opinion among these parties was, that eagles, as a race of destroyers and pests, ought to be exterminated at all times, and by every means—that, in short, the killing of an eagle was almost, if not altogether, as meritorious a deed as the saving of a human life. In proof of this fact, the bell pulls, and in some cases the handles of whips, were finished off with eagles' feet, in testimony of the victories which had been gained over them. When, however, we came to the main point of the case, the real harm which had been done by the eagles, they were invariably obliged to have recourse to other times, and other places, for their instances. "No great harm had been done by the eagles since they had possession, neither did they recollect of any which had happened just in that part of the country ; but they had been told, and they had no doubt of the truth, that very serious damage had been done half a century ago, and even in times much more recent, at some place thirty or forty miles distant." No matter for the place—this was the invariable account : the eagles of the one side of the great ridge of the Grampians, or of any of the other ridges, less extended but hardly less elevated, and, generally speaking, much more wild and picturesque, always did their mischief on the other side. For instance, the eagles of the glens of the Tay, the Ila, and all the southward running rivers, were always troublesome fellows to the people of Badenoch ; while the eagles of Strathspey hewed down the lambs and muttons in the south as if the birds had been Samson and the flocks Philistines ; and so marvellous were the tales that we were often put in mind, that not the eagles but the narrators might probably have found and armed themselves with the weapon of the puissant son of Manoh.

What may be done by those eagles which have a portion of the character of the vulture in them, which come near the banks of the streams and shores of the creeks, and approach more closely to the habitations of man, we have not the means of ascertaining from personal observation ; but it is very unlikely that, under any state of things, the golden eagle can, or could be very injurious to man. As for killing lambs, the eagles do not come so far down, excepting at a rare and

random dash, on the places where the lambs are dropped; and, if any breeder of sheep should be unwise enough to send his brood ewes to the upper glens and summits near the dwelling of the eagles, he would stand in need of no eagles to kill the greater part both of the young and the dams, though crows and ravens to clear off the carrion might be of service to him.

Golden eagles are now unknown as resident birds in a wild state in England. In Scotland they are confined to some of the wildest spots, invariably inland. It is usually said that there are some in the craggy mountains near the lakes of Killarney, in the county of Kerry, in Ireland; though, from the accounts which we have heard of their preying in the lake (at least occasionally), we should be inclined to believe that they belong to another species which is far more common than the golden eagle, which does haunt near the waters, and occasionally fish; and the characters of which may be supposed to vary a little, according as the nature of its pastures leads it to be more of a land preyer, or more aquatic. Golden eagles are also found in the wild and rocky places among most of the higher mountains on the continent of Europe, though we believe that, in those localities, they are not numerous; and they do not range far from those rocks in which their eyries are placed.

Golden eagles are subject to considerable variations of colour, both with age in the individual, and in different individuals; and they are also subject to considerable variations in size; the male bird being smaller than the female, as is usual among birds of prey, and individuals of both sexes varying a good deal in size from each other, even when they are full-grown. These differences of size are understood to arise chiefly from the different supplies of food which they get while they are in the nest, and up to the time when they attain their full size. When young they are exceedingly voracious, as might be supposed of birds who have to elaborate such well sinewed frames and such firm feathers. The parent birds, true to the adaptation of necessity and supply, which runs so conspicuously through all nature, labour most industriously to obtain the requisite quantity; and where prey is abundant, the larder of an eagle is sometimes so well stored, as to tempt the cupidity of human plunderers. If, however, the requisite quantity is not to be had, even the strength and the enduring perseverance of an eagle is of no avail, because she can neither cultivate that on which she supports her family, nor entice it within the range of her excursions. This is also the time at which the birds are most discursive and most frequently on the wing, and consequently it is the time at which she stands in most danger of being destroyed by man; therefore the labour of feeding the brood sometimes devolves wholly on the one parent, and this must farther tend to dwarf the size of the brood.

Making allowance for the variations of which we have taken notice, the following are nearly the average external characters of the female golden eagle, which is the more powerful bird, and therefore the typical one, at that age when the colours expressive of youth have disappeared, and those of old age have not come on:—Tip of the bill and the claws black; basal part of the bill bluish; naked skin or *cere* at the base of the bill, and toes, which are the only naked parts of the feet, yellow; irides of the eyes bright orange brown, inclining to yellow; crown of the head and

nape of the neck bright orange brown; sometimes, in birds which have passed a certain age, margined with white, which becomes broader as age increases. The feathers on the neck narrow, pointed, and very distinct, bristling out from each other when the bird is in a state of excitement; chin and throat rich dark brown, passing gradually into pale reddish brown on the under part, in which it terminates in the vent feathers, and feathers on the tarsi, the latter being slender and very much produced; upper part deep orange brown, margin rather paler, which gives a bold relief to the individual feathers; coverts of the wings nearly the same; secondary quills clouded with various shades of brown; and primary quills black. Tail purplish brown, barred across with blackish brown, and having a broad line of the same across the extremity. The feathers are all remarkable for the firmness of their texture, and their profusion in the eagle feather, which gives them something of the same appearance as if they were imbricated scales. For some of the particulars of the beak, the claws, the bones, and the adaptation for flight, see the article BIRD.

In the young birds, the irides are more brown, and the brown on the back and wing coverts is deeper, and the margins of the feathers not so distinct or rich in the tint. There are patches of white on the under part; the insides of the thighs are white; the webs of the feathers of the wings have also more or less white on them; and in the first year's plumage, a large portion of the basal part of the tail feathers is white. In this stage of plumage, the young have often been described as a different species, under the name of the "ring-tailed" eagle, though the ring, which is at first little else than the broad brown bar on the end of the tail, might of itself have sufficed to identify the species. As the bird advances to maturity, the white becomes less and less every year, and in the fourth moult it generally disappears, though there may be a few that retain the white of youth partially on the under part and the base of the tail-feathers until the white of age begins to appear. The length of the mature female is usually about three feet, and the extent of the wings between six and seven feet; though specimens of much larger dimensions have been mentioned.

As this bird is highly characteristic of some of the wildest scenes in Britain, and withal very ornamental, we shall close our notice of it by an extract from Mudie's Feathered Tribes of the British Islands:—

"From what I have noticed of their habits, I am inclined to believe, that eagles in general choose those rocks, where, with an elevation and wildness which gives them the seclusion that they seem to like in their retreats, they have the command of a double pasture: one, a hill, which they beat with a lower flight when the weather is dusky, and a lower and richer one, which they beat at a greater elevation when the weather is clear;—at all events, I have seen them on the upper moors flying low on dusky days, and again sailing majestically over the lower and richer valleys when the day was fine.

"The eyrie of those magnificent birds, which is a dwelling as well as a cradle for their broods, is placed on some ledge of the rock, and rarely on a tree, unless where the tangled roots spring from the cliff, and offer a broad space, which can be covered with sticks. The place is, generally, slippery with the refuse of their prey; and when the young are there, it is usually well stored with provisions, which consist

indiscriminately of quadrupeds and birds. The eggs are seldom more than two, though some say that there are occasionally three, and that in such broods there are two females, one of which becomes an "odd eagle" and lives solitary, growing to a very large size, being very ferocious, and dropping addled eggs occasionally on the mountain tops; but the tale wants verification.

"The eagle generally strikes her prey upon the ground, and the stoop is almost instantly fatal to any animal on which she pounces. The mere fall of a body of twelve or even eighteen pounds in weight, from an elevation of 1500 or 2000 feet, would be powerful; but the eagle shoots down with a great initial velocity, and as she delivers the whole of her momentum with the claw, she not only dashes the animal to the earth, but plunges the claw into its body up to the toe, dislocating the spine or breaking the skull of the feebler quadrupeds, such as hares, and the death of grouse and black game, which form a very large portion of the prey, is instantaneous. The view upon which the eagle proceeds must be a steady one, for on the ground she seldom misses her pounce, though she often does when she attempts to hawk on the wing, as her broad wings and forward rush are both unfavourable to turning, so as to follow the motions of the bird. If the prey is small, she has the power of slackening her speed as she descends, so as to temper the ultimate effect to the necessity there is for it, otherwise, strong as she is, she might be injured by the collision with the ground. An unrestrained stoop from her greatest height would be sufficient to dash even an eagle to pieces. If the pounce is not fatal, the clutch instantly follows, in the giving of which the whole weight of the bird—in the utmost excitement, with the head elevated, the neck stiff, the feathers of the head and neck erected, and the wings shivering so as to keep the pressure on the instruments of death—is upon the claws. With small animals, even when they show signs of life after the pounce, the clutch is given with one foot only, and the bird is less excited; but in no case is the prey touched with the beak, or even looked at, until all motion in it has ceased. When the eye has guided the descent, and the talons have taken effect, the office of the eye is at an end, and the work of death is committed to instruments admirably fitted for carrying it into effect. In general the prey is borne off, but in some cases it is devoured on the spot, that taking place, of course, at those times when the bird has only herself to provide for.

"In winter, when her pastures are covered with feet or even with fathoms of snow, the eagle is often for weeks together without food. That may be one of the causes (for all phenomena, whether of birds or any thing else, have causes) why she drives the young not only from the eyrie, but from her haunt generally before the intensity of winter sets in; and it is said, that she drives them lower down the country, where the chances of food are more numerous.

"Thus the instinct which we are apt to regard as an unkind one is the very best adapted for the preservation of all; and the eagle is, in her way, just as tender a mother as any other animal. As it is necessary for her brood to grow fast and get strong before the inclement season sets in, she is most indefatigable and most successful in supplying them with food, and equally daring in the defence of them against any intruders that may have the temerity to invade an

eagle's nest; and when they are so far matured that they can kill prey for themselves, she drives them down where prey is more easily obtained, while she herself remains to brave the winter at the very throne of its dominion. Herein we may see a beautiful instance of that balance and reaction which can be traced through all the works and operations of nature. Populating and cultivating narrow the bounds and diminish the number of eagles, but as there is a constant tendency in the eagles to spread and extend their territory and their numbers, that tendency instantly acts upon the withdrawal of the restraint; so that when the eagle becomes necessary in order to maintain the balances of races, and the perfection of the whole of nature, she returns by as unerring a law of nature as that which guides her to her prey.

"Her strength of endurance also enables her to keep her footing and preserve her existence, under circumstances to which the powers and the life of almost any other animal would be obliged to yield. The same elastic ligament, which, of its own nature, and without effort from the bird, compresses her toes in clutching, enables her to cling to the pinnacle of the rock, and to cling the more firmly the ruder the blast. The claws are not used in those cases, as that would injure their points, and unfit them for their proper functions; but the pads and tubercles hold on upon places where the foot of all else would give way; and the eagle sits with closed wings and close plumage, as if part of the rock itself, while the wind roars and the snow drives, tearing the bushes from their roots, sending them rolling over the precipices, and literally scourging the wilderness with ruin. The strength of the hill ox, the fleetness of the mountain deer, and the resources of the mountain traveller, are often unavailing; and when the storm breaks, the signal of the raven and the crow points out the place of their bones; but the bones of the eagle are not thus given by nature to be tugged at by ignoble birds. Queen of the tempest, she rides as secure, amid its fury, as when, on a cloudless and breezeless day, she floats down the valley with easy and almost motionless wing."

We may remark that, notwithstanding the reputation which this celebrated species long has had for being an unreclaimable tenant of the wilds, it is by no means unsusceptible of kindly treatment, and that, if taken young and duly fed, it may be gradually brought to familiarity and even to playfulness. But though this may be done, as probably every animal, whether of the land, the air, or the waters, may be familiarised by feeding, one does not exactly see the use of it; and the bird is certainly not only out of its element, but out of its proper use in nature, in any other place than on its native rocks and in its favourite skies.

The young of this species, while they have the white on the basal part of the tail, partially on the under part of the body, and on the insides of the thighs, and also the brown on the upper part less broken by the yellowish margins of the feathers, are very apt to range into places where the old ones are never seen; and as they sometimes take up their abode there, and build nests and breed, while still in the young plumage, we need be little surprised that they should have been so generally and so long looked upon as a separate species, and described and figured as the "common eagle." The more judicious naturalists were always of opinion that they were the

same species ; and recently the fact has been demonstrated by Selberg.

THE IMPERIAL EAGLE (*A. imperialis*). This is a large and powerful bird, though not so compact in its form, or perhaps so strong in proportion to its size, as the golden eagle. Still it is a long-winged eagle and a mountaineer, and probably approaches nearer in all its habits to the golden eagle than any other of the race. They are, however, easily distinguished from each other, both by the form of the body and the colour. The imperial eagle is proportionally shorter in the body, and thicker, bearing nearly the same relation to the others that the hawks do to the falcons ; and being altogether a bird of more southerly climates, and probably less enduring habits. The chief distinctions in colour are: the nostrils transverse, a large patch of white on each shoulder, the tail black, barred and waved with greyish, and the ground colour of the female brownish yellow, rather pale, and broken by brown spots ; the crown of the head and the nape are furnished with pointed feathers of a dull rust brown colour margined with lighter. The under part of the belly is a yellowish rust colour, and the whole plumage apparently less firm in its texture and certainly less decided in its colours. The white on the scapulars, and the black and grey tail, instead of one of different shades of brown, always suffice to distinguish this bird from the golden eagle, even when that bird is immature, ranging the country in quest of a mate and a home, and being the ring-tail of British describers, and the common eagle (*l'aigle commun*) of the French, of Buffon, and even of Cuvier.

The imperial eagle is unknown in the British islands, or in the mountains and woods of western Europe ; neither is it very abundant even in the Alps, especially on the northern declivities of those mountains. In the eastern Alps, in Hungary, in Dalmatia, and so onward through Greece and Turkey, it is by no means rare ; and although its localities have not been so clearly traced in Asia, it is probably to be met with in all the wooded mountains of the western and central parts of that continent, from Caucasus southward, and eastward as far as the Himalaya. It is also found in Egypt and in Barbary, though it probably does not extend southward across the desert of Sahara, the eagle of Guinea being apparently a different species.

Its habits are described as being a little different from those of the golden eagle. Though found more frequently in elevated places, it is not so decidedly a bird of the mountain cliffs as the other ; neither does it beat for its prey upon the naked pastures, or at such a height in the air. The wooded hills are its most usual haunts, though, from the length of its wings, it is of course not a preyer in the close forests. The nest is constructed indiscriminately on the ledges of woodland rocks, and in lofty trees, though the latter are preferred where they are equally well situated for the pastures. The eggs are three or four in number, and of a dull white colour. The voice of this species is represented as being more loud and clear than that of any of the other eagles, owing, as is said, to the more compact structure of the trachea.

From the abundance of this species in Greece, and in the mountainous parts of Italy, especially Naples and the island of Sicily, it is highly probable that this, and not the golden eagle, is "the bird of Jove," as fabled by the ancients ; and certainly the representations which have come down to us from the Greeks

and Romans have the greatest resemblance to this species. It appears indeed to be the eagle of painters and sculptors all over Europe, and even in those parts of it where the bird, in a state of nature, is altogether unknown. Hence, in a historical point of view, the imperial eagle is rather an interesting bird. As these birds come into places which are rich at certain seasons, and in which the greater abundance and variety of animals probably meet with more casualties than they do in those colder climates, for the endurance of which the golden eagle is so well fitted, it is probable that they partake a little of the vulture character, and help to clear away the carcases of animals, in the death of which they have little or no concern. Their young being rather more numerous than those of the golden eagle, and equally voracious during the period of their growth, the old birds have no small labour in finding the necessary supply of food ; and the time when they have young may be known by their frequent appearance on the wing, and the diligence with which they range over the pastures. These pastures are, in general, more abundantly stocked than the pastures of the golden eagle ; but as the vegetation is more rank in the early part of the season, the prey is not so easily discerned from a height in the sky. They do not, indeed, fly so high as the others ; but they have the eagle habit of stooping on their prey, and not chasing it on the wing, or beating the bushes for it on low flight.

THE LITTLE, OR SPOTTED EAGLE—*A. maculata*. This is a much smaller species than either the golden or the imperial eagle, being one-third less in the linear dimensions, and estimating animals as the cubes of these, which is the proper way of comparing their volumes, if not their strength, the little eagle is rather less than equal to half the others in volume. It appears to form a sort of connecting link between the eagles and buzzards ; and like the latter, and different from the former, it has the tarsi elongated and slender. Indeed, though the more eminent of the authorities class it with the eagles, it appears to be more of a buzzard in the greater number of its characters.

It is a native of the mountain forests of the southern parts of Europe, and very common in or near the woods of the Apennines ; but it is rarely seen in the central countries, and never in the north. It is also found distributed over great part of Africa, and bears so much resemblance to the little eagle of Senegal, and that of the Cape, and even to some which are found in the south-eastern peninsulas of Asia, and in the Oriental islands, that a particular description of them does not appear to be necessary. It appears, indeed, that eagles are peculiarly subject to climatal differences of colour, as even the golden eagle, which is probably the most local of the whole, is sometimes spotted with white.

As this species is less powerful and also less energetic than the larger land eagles, its prey is of a more humble description. It does, of course, catch rabbits and little birds, and occasionally a duck, especially a young one ; but to these it adds mice, reptiles, and some of the larger species of insects. The plumage of the mature bird is brown, varying in depth of tint both in the individual, with age, and in the sexes.—The tail is dusky or blackish, with bars of paler, and the extremity reddish. The under parts, and lower coverts of the tail, are bright brown ; the cere and feet yellow, and the bill and claws black. The immature birds have the coverts of the wings, and part of

the scapulars marked with large spots of greyish white. They have similar spots on the secondary quills, and the upper parts of the wings are marked with smaller yellowish spots. It is when in this immature state that it is called the spotted eagle.

THE WEDGE-TAILED EAGLE—*A. fucosa*. Why this species should be called *fucosa*, or “painted,” it is not easy to say, unless it be on account of the depth of its colour; for the tints are any thing but rich. Its general colour is a dull brownish black, with a reddish tinge on the breast. It is a native of New Holland, and has not been found out of that country. Its form, its air, and its linear dimensions, bear no inconsiderable resemblance to those of the golden eagle; but it is more slender and feeble, and the wedge-shaped tail, different from the broad fan-tail of the golden eagle, indicates a very considerable difference of habit. The broad fan-tail indicates a bird which has the habit of frequent ascent and descent, which is that of the golden eagle, and indeed of all birds that have the tail of that form, whether they be birds of high flight, like the eagle, or only birds that leap up to their perches, or rise to avoid enemies upon the ground. The wedge-shaped tail, again, almost invariably indicates a bird which has to make its way through some sort of tangle, the boughs and branches of trees, bushes, or tall herbage of some kind. The species of eagle under notice, of which a specimen has been at the gardens of the Zoological Society of London, is described as feeding on the emeu, and the young of the kangaroo; but in what manner it captures its prey, whether by stooping, like the eagles properly so called, by pouncing on them, by level flight, from caves, or by any other method, has not been said, neither have we any correct information respecting the nest-building or the other habits of the bird.

These are the principal species of eagles, properly so called, that inhabit the land, and for the most part feed upon warm-blooded animals only. The probability is, that there are more in those places, the mountains and forests of which have not yet been explored. But the forests of tropical countries are not proper localities for the typical eagles; they are too rich and tangled for allowing these birds to act; and, therefore, we may rather expect to find in them vultures, or those short-winged fishing eagles which feed readily upon carrion, and otherwise appear to have not a little of the vulture in their composition.

All those land eagles have the under or concave sides of the toes of a more trenchant and tearing character than those that fish, the claws of the latter having more of the character of prehensile hooks. No doubt they can inflict very severe wounds; and as their points are generally finer, they can penetrate the body of an animal with the exertion of less force. The toes are also more adapted for clutching, so as to take a hold, and lift and carry a weight; and the tarsi are bare of feathers and covered with reticulated scales, like those of the wading birds.

These differences of structure are very well adapted to their differences of habit, so much so that if we be well acquainted with the habits of any one of either of the subdivisions, we can have no difficulty in judging of the leading habit of any other from the structure. The land eagles do not require the very fine points to their claws, and in the case of those who tenant the rocks, the fine points would be apt to be broken or worn, notwithstanding that they are not

used directly on the surface of the stone. Their prey is on the ground when they penetrate it with their talons; and thus they act against a solid resistance; and as this compensates for the comparative bluntness of the claw, and the blunted claw inflicts by much the more severe and painful wound, it is the best one for their habits. We find a parallel case in the teeth of the lion, which, though large and powerful, are comparatively blunt. But the fishing eagles have to strike their finny prey against the water only, which has no cohesion as the earth has, and therefore, it gives way like an elastic spring; and if the points of the claws were not very sharp, they would not penetrate the skin of the fish. So, also, if they were furrowed and grooved like the talons of the land eagles, which use theirs in killing the prey, and not in clutching it for the mere purpose of lifting, they would tear and lacerate, and, in the case of a heavy fish, cut their way out of its substance. By being round and smooth on their under sides, the talons of the fishing eagles have no tendency to do this. The articulations of the toes are also admirably fitted for retaining a powerful hold. They contract much more completely in the distal joints than those of the land eagles; they, in fact, bend till the point of the claw is on the same level with the root, and thus every single claw lifts like a perfect hook, while the connexion of the foot keeps them all in their places. The strain of the clutching is at the same time not wholly upon the muscles which contract the toes, for the bird does not dangle the fish with the toes, at full length, but binds all the joints, which throws part of the strain upon the ligament, and the rest of it is parted among all the muscles of the leg.

There are considerable differences of structure and habit among the fishing eagles; some of them approach the land eagles in many of their characters; and the ones that do so are long-winged, and prey upon land animals, as well as upon the produce of the sea; others, which are still longer winged, are more exclusively aquatic, and they have the feet most approaching to that form which we have described as a proper fishing foot; and others, again, have the wings shorter and broader, living more in the vicinity of those waters the banks of which are thickly covered with trees; and they partake in some measure of the habits of the vultures, and also of the hawk,—they eat carrion and any offal that comes in their way, and they also chase birds on the wing, and strike them in the air, which is not a habit of the true or typical eagles. It is not, perhaps, very easy to follow accurately the distribution of these; and many of them, like those who inhabit the dense forests, are but imperfectly known; but we shall begin with those that are most nearly allied to the land eagles.

THE ASH-COLOURED EAGLE (*A. cinerea*). This species is common on many places of all the shores of Britain, and hence it has various names. In many places it is “the eagle” simply, because it is the only one which makes its appearance. It is also often called the “white-tailed eagle,” from the colour of its tail; in some places it is “the bog eagle;” and in those parts of the lowlands of Scotland where it is popularly known, it is called the “erne.” The name which we have given it is as little objectionable as any; and it harmonises with the only other true eagle, native in Britain, which gets its name from the rich yellowish brown on the margins of the feathers.

As is the case with the young of the golden eagle,

the young of this has often been described as a different species. The cause of this appears to have been of the same nature with that which led to a similar mistake in the case of the golden eagle. The young birds and the old ones are, as in that species, different in colour; and about the same length of time elapses before the perfect mature plumage is assumed. The young are much more discursive along the shores than the old birds; and as the probability is that they do not pair till they have passed two winters, they may be found on the shores when a year old, in the breeding time, when the old ones, which prefer trees to rocks for their nesting places, are then more inland. The young, however, before they have acquired their perfectly mature plumage, do pair, and have at least one brood, and in all probability two. Thus the birds in the one plumage appear when the others do not; they appear more on the shores, and there are pairs and broods among birds in both plumages. Therefore, these are as satisfactory proofs as can be obtained in most cases that there are really two distinct species; and the fact would not have been called in question, if it had not been ascertained by direct observation of the change and the age at which it takes place, that these two apparent species are one and the same. The young was the "sea eagle" of British describers, and called *Aquila ossifraga*, or the "bone-breaking eagle," while the adult was the "cinereous eagle" and the "white-tailed eagle."

This species is as large as the golden eagle, or probably a little larger; but its form is not so compact, it does not appear so firmly knit, and its expression is by no means so lively or intelligent. Still it is a very powerful bird, and if we looked only at the size of its destructive weapons, we would be apt to conclude that it were the more formidable bird of the two. Both its bill and its talons are larger than those of the golden eagle, and the talons are more crooked and sharper at the points. But when we come to examine both birds narrowly, we find that there are indications of inferiority about the present species. The beak is yellow, and, though larger in size, it seems softer and weaker than that of the other, and not so firmly based on the bones of the head. Its cutting edges are also not so decidedly formed. It is straight for a greater length at the base, and the toothed wavings, which enable the beak of the other to take so firm a hold in tearing, are nearly obliterated. The beak of the one resembles a smaller instrument of steel, that of the other a larger instrument of soft iron. The claws too, though better clutching and retaining instruments, are not of so mangling a character. They are a little flattened on their under sides; but they are without the prominent ridges which enable the others to act with such effect.

But, after all, this eagle is a very powerful bird and well armed for the work of destruction. As compared with the golden eagle, it follows the usual law of the difference of birds which are wholly or partially marine, and birds which are exclusively inland. It is found inhabiting much farther to the north, and it is more discursive, and ranges more with the seasons. It is found in Iceland, in the Faroe Isles, in Shetland, in the Orkneys, in the Western Isles, and on the wild and rocky shores of the west of Scotland generally. It sometimes ranges into England, but it is not numerous so far to the south. In summer it haunts and hovers over the fresh water pools and morasses, where water fowl breed in great numbers, and is very de-

structive of them; and it also attacks the smaller quadrupeds, and, as is said, even sheep and deer, especially in the early part of the season when they are sickly and weak.

As these birds are of strong wing, and capable of enduring hunger for a long time, they extend their winter excursions often to a great distance from their breeding places. Those which appear in England, and although they are not numerous, they are found in the most southerly parts as winter visitants, are understood to leave the north when the sea is too stormy for them, and they are frozen out on the northern lands. It has sometimes been said, that the appearance of these eagles in greater numbers than usual is accompanied by more than the usual supply of wild fowl.

They retire a little toward the north in the breeding time. Those which breed in the far north countries build in the rocks, choosing the most elevated and inaccessible places; and indeed they have no alternative, as there are no trees in those countries. In places where there are trees in wild and secluded situations, either near the sea or the inland waters and marshes, though never very far inland, they give the preference to this. It is not understood that they keep so constantly to the same eyrie, or even to the same locality, as the golden eagles. There is one particular mentioned with regard to their broods and their apparent numbers, in which they agree with many of the larger sea birds which build on the cliffs. Their eggs are few in proportion to their apparent numbers, being never more than two, and often only one.

The general colour of these birds in the young state, or before they have acquired the mature plumage, is dark brown, with the margins of the feathers of a lighter tint. On the lesser coverts, the scapulars, and the throat, these margins are very pale, approaching to a reddish straw colour. The under part at this age is spotted, and among the varied spottings there are always some patches of white. The tail is dark brown, as deep in the tint at the extremity as the bar on the tail of the golden eagle; but the other parts are much mottled with lighter brown. The bill at this age is of a leaden grey or bluish colour, but very different in tint from that of the golden eagle. As the bird approaches maturity, the feathers on the head become paler in their tint, and the bill alters to a straw colour; the cere and irides acquire a tinge of red; and the pale margins of the feathers on the upper parts and the throat fade off, rendering the brown more uniform and unbroken. The mottlings also disappear from the under part of the bird, which becomes a deeper brown than the upper. The most remarkable change, however, is in the tail and tail-coverts, which, from being the darkest parts of the bird in the early plumage, become pure white in maturity.

This is the species of which so many marvels are told by the people of the north, about its carrying away children, and an endless number of other adventures. But those northern people, who have been always obliged to have recourse to tales of wonder, in order to help them through the tedious darkness of their long winter nights, have thrown an air of romance around almost everything that is connected with their countries, whether in natural history or in any thing else; and as this eagle is one of the most conspicuous of their native birds, we

need not wonder that it has come in for its full share of the exaggerations ; yet, in spite of the exaggerations, it is a bird of no small interest to all who love nature, and wish to study its phenomena and economy in the wildest places.

The fishing of this eagle is not so habitual, neither is it performed in so fine a style, as that of another and smaller species, afterwards to be described ; but still it does occasionally fish, and that in the sea, against the rocky and precipitous shores, which it prefers, as it never comes upon the flat ones unless they are in the neighbourhood of marshes, to which it can make incursions inland. For its permanent residence such places must be lonely, and far from those which are thickly inhabited by mankind, so that the sea-eagle, though much more frequently seen than the golden eagle of the mountains, is still, like that, a bird of wild nature in its general habits. Though not unknown upon any of the wild or cliffy shores of England, where they partake of that lonely character in which it delights, this bird may be considered as more abundant on the western and northern shores of Scotland than on any other of those of Britain. There it may be met with all along the deep bays, or lakes, as they are called, which run far into the land, and are peculiarly wild in their character ; and perhaps there is no place in which it is more common than about Loch Carron and Loch Roan, and the great inland lake Loch Murce. The latter is an exceedingly romantic spot. The cliffs are bold and rugged, and there are trees, some old hollow ones, of large dimensions, on the islets in the loch, or the more romantic places in its vicinity. Upon these, or in the bushes, which are found higher up, chequering the grey of the cliffs with rich green foliage in the summer months, these eagles form their nests ; and as, in that situation, they have both sea and land within the easy range of their wing, they appear to be quite in their element. Their appearance is indeed so common, and their size, and the style of their flight, so conspicuous, that they add not a little to the effect of scenery naturally of the wildest character.

The breadth of the island at that part is not more than the range of a sea-eagle's flight, and thus they are found on the rocky shore of the east about the Ord of Caithness, and also along the whole of the north of Sutherland, as well as on the west. The northern shore there, from Cape Rath eastward, along the whole of Sutherland and great part of Caithness, is as wild as can well be imagined. The current which sweeps through the Pentland Firth alternately to the east and the west, in consequence of its being high water on the one side of the country when it is low water on the other, sweeps the bases of the cliffs with an ever-rolling flood ; and, when the north wind blows in its fury, which it does in the latter part of the season, just before the hills have received their winter covering of snow, the roll of the north sea comes in mountains, and breaks in thunder, so that the whole line of the coast is not only, so to speak, worn to the bones of the mountains, but these are honeycombed into innumerable caves, many of them reaching to a great distance below ground, and some of them perforated at their landward extremities by large apertures to the day, up through which the dashing water spouts in splendid jets, sometimes raising large stones to the height of a good many feet, from which they fall with tremendous crashes back

again upon the aperture. The resistance of the weight of the stone, if a large one, condenses the air which the surge drives before it into the cavern, till that becomes charged like an air-gun, from which both the stone and the water are literally shot upwards into the air ; and when fishes are abundant near the coast, they are apt to lose command of themselves in the turmoil of the waters, and to be flung upon the rocks by those singularly magnificent jets. On such a shore the sea-eagles are quite in their element, and have associates of more aquatic character to assist them in filling up the picture. Gannets, and skags, and cormorants, plunging headlong into the waters, divers driving about through the restless surges, gulls wheeling and wailing on the wing, and ever and anon dipping down to catch those smaller fishes which come near to the surface, and skuas driving at the gulls, making them disgorge their booty, and catching it ere it falls into the sea. Meanwhile, the sea-eagle sits on the rock, eyeing the tumult of nature, but always now and then making a clutch at the waters for her share of the booty.

Nor in the more tranquil season of the year is the prey of the eagle less abundant, though she then finds it of different quality, and in a different situation. The short summer in these northerly places is as much a time of repose as the change from summer to winter is one of turbulence ; and as there is little night, and no absolute darkness, the situation is peculiarly favourable for the breeding of those wading and swimming birds which are twilight feeders. Accordingly, the morasses, and the grassy and rushy margins of the ponds and lakes, are full of the nests of these birds, and during the time that they are there, the sea-eagle fares as well as a fowler as she does as a fisher at other times of the year.

THE WHITE-HEADED EAGLE (*Aquila leucocephalus*). This is an American species, agreeing in its general habits with the white-tailed eagle of Europe, but differing from it in its appearance, and especially in the position of the white, upon which the common names of both are founded. It is usually said that this species is occasionally, or rather not unfrequently, seen in the north of Europe, and it may have been observed there, though there is at least a possibility that the osprey, which is common to both countries, and much more frequently seen on the shores, even in America, than the white-headed eagle, may have been mistaken for it. They both fish, though the osprey is by far the more habitual and the finer fisher of the two, has its plumage of a much more aquatic character, and dashes far more fearlessly into the water. The old osprey, however, has the head white, so white that it has got the popular name of the "bald" buzzard, just as the species under notice has got that of the "bald" eagle. On close inspection of the birds, when they are seen together in an aviary or a museum, it is very easy to distinguish this eagle from the osprey, by the size, the shape, the plumage, and the general air and character. But when we come to examine the larger birds of prey in wild nature, we find our aviary and museum knowledge of much less use to us than we could wish, or even believe, till we actually make the trial. We cannot come so near the birds as that we can be sure of the details of appearance upon which the specific descriptions are usually formed. We are not very good judges, even of size, when we change very much the characters of our locality ; and one who, for the first

time, sees a large bird of prey floating high over bold and rifted cliffs, the peaks of which shoot up to some thousand or fifteen hundred feet in height, as is not unfrequently the case on those shores of Europe which the white-headed eagle has been said to frequent, can form no very accurate estimate of its size. In all such cases, whatever is seen on or over the top of the cliffs by a spectator below, "borrows of the cliff," and is larger to the fancy than it would be in fact if we had it on the level ground, and could measure it with a line.



White-headed Eagle.

As this bird is certainly much more characteristic of North America than of any other part of the world, and, as it is there a bird of the greatest interest, we should be doing it injustice if we attempted to describe it in any other language than that of Wilson:—"This distinguished bird," says this equally distinguished naturalist, "as he is the most beautiful of his tribe in this part of the world, and the adopted emblem of our country, is entitled to particular notice. The celebrated cataract of Niagara is a noted place of resort for the bald eagle, as well on account of the fish procured there, as for the numerous carcasses of squirrels, deer, bears, and various other animals that, in their attempts to cross the river above the Falls, have been dragged into the current, and precipitated down that tremendous gulf, where, among the rocks that bound the rapids below, they furnish a rich repast for the vulture, the raven, and the bald eagle, the subject of the present account. Formed by nature for braving the severest cold; feeding equally on the produce of the sea, and of the land; possessing powers of flight capable of outstripping even the tempests themselves; unawed by any thing but man; and, from the ethereal heights to which it soars, looking abroad at one glance, on an immeasurable expanse of forests, fields, lakes, and ocean, deep below him, he appears indifferent to the little localities of change of seasons; as in a few minutes he can pass from summer to winter, from the lower to the higher regions of the atmosphere, the abode of eternal cold, and from thence descend, at will, to the torrid or the arctic regions of the earth. He is, therefore, found at all seasons in the countries

he inhabits; but prefers such places as have been mentioned above, from the great partiality he has for fish.

"In procuring these, he displays in a very singular manner the genius and energy of his character, which is fierce, contemplative, daring, and tyrannical; attributes not exerted but on particular occasions, but, when put forth, overpowering all opposition. Elevated on the high dead limb of some gigantic tree, that commands a wide view of the neighbouring shore, and ocean, he seems calmly to contemplate the motions of the various feathered tribes that pursue their busy avocations below; the snow white gulls slowly winnowing the air; the busy *tringæ* coursing along the sands; trains of ducks streaming over the surface; silent and watchful cranes, intent and wading; clamorous crows; and all the winged multitudes that subsist by the bounty of this vast liquid magazine of nature. High over all these hovers one whose action instantly arrests his whole attention. By his wide curvature of wing, and sudden suspension in air, he knows him to be the fish hawk, settling over some devoted victim of the deep. His eye kindles at the sight, and, balancing himself, with half-opened wings, on the branch, he watches the result. Down, rapid as an arrow from heaven, descends the distant object of his attention, the roar of its wings reaching the ear as it disappears in the deep, making the surges foam around! At this moment, the eager looks of the eagle are all ardour; and, levelling his neck for flight, he sees the fish hawk once more emerge, struggling with his prey, and mounting in the air with screams of exultation. This is the signal for our hero, who, launching in the air, instantly gives chase, and soon gains on the fish hawk; each exerts his utmost to mount above the other, displaying in these rencontres the most elegant and sublime aerial evolutions. The unencumbered eagle rapidly advances, and is just on the point of reaching his opponent, when, with a sudden scream, probably of despair and honest execration, the latter drops his fish: the eagle, poising himself for a moment, as if to take a more certain aim, descends like a whirlwind, snatches it in his grasp as it reaches the water, and bears his ill-gotten booty silently away to the woods.

"These predatory attacks and defensive manœuvres of the eagle and the fish hawk, are matters of daily observation along the whole of our sea board, from Georgia to New England, and frequently excite great interest in the spectators. Sympathy, however, on this, as on most other occasions, generally sides with the honest and laborious sufferer, in opposition to the attacks of power, injustice, and rapacity, qualities for which our hero is so generally notorious, and which, in his superior, *man*, are certainly detestable. As for the feelings of the poor fish, they seem altogether out of the question.

"When driven, as he sometimes is, by the combined courage and perseverance of the fish hawks from their neighbourhood, and forced to hunt for himself, he retires more inland, in search of young pigs, of which he destroys great numbers. In the lower parts of Virginia and North Carolina, where the inhabitants raise vast herds of those animals, complaints of this kind are very general against him. He also destroys young lambs in the early part of spring; and will sometimes attack old sickly sheep, aiming furiously at their eyes.

"In corroboration of the remarks I have myself made on the manners of the bald eagle, many accounts

have reached me from various persons of respectability, living on or near our sea coast. The substance of all these I shall endeavour to incorporate with the present account.

"Mr. John L. Gardiner, who resides on an island of three thousand acres, about three miles from the eastern point of Long Island, from which it is separated by Gardiner's Bay, and who has consequently many opportunities of observing the habits of these birds, has favoured me with a number of interesting particulars on this subject, for which I beg leave thus publicly to return my grateful acknowledgments.

"The bald eagles,' says this gentleman, 'remain on this island during the whole winter. They can be most easily discovered on evenings by their loud snoring while asleep on high oak trees; and, when awake, their hearing seems to be nearly as good as their sight. I think I mentioned to you, that I had myself seen one flying with a lamb ten days old, and which it dropped on the ground from about ten or twelve feet high. The struggling of the lamb, more than its weight, prevented its carrying it away. My running, hallooing, and being very near, might prevent its completing its design. It had broke the back in the act of seizing it; and I was under the necessity of killing it outright to prevent its misery. The lamb's dam seemed astonished to see its innocent offspring borne off into the air by a bird.

"I was lately told,' continues Mr. Gardiner, 'by a man of truth, that he saw an eagle rob a hawk of its fish, and the hawk seemed so enraged as to fly down at the eagle, while the eagle very deliberately in the air, threw himself partly over on his back, and, while he grasped with one foot the fish, extended the other to threaten or seize the hawk. I have known several hawks unite to attack the eagle, but never knew a single one to do it. The eagle seems to regard the hawks as the hawks do the king-birds, only as teasing troublesome fellows.'

"From the same intelligent and obliging friend, I lately received a well-preserved skin of the bald eagle, which, from its appearance, and the note that accompanied it, seems to have belonged to a very formidable individual. 'It was shot,' says Mr. Gardiner, 'last winter, on this island, and weighed thirteen pounds, measured three feet in length, and seven from tip to tip of the expanded wings; was extremely fierce looking; though wounded, would turn his back to no one; fastened his claws into the head of a dog, and was with difficulty disengaged. I have rode on horseback within five or six rods of one, who, by his bold demeanour, raising his feathers, &c., seemed willing to dispute the ground with its owner. The crop of the present was full of mutton, from my part blood Merinos; and his intestines contained feathers, which he probably devoured with a duck or winter gull, as I observed an entire foot and leg of some water fowl. I had two killed previous to this, which weighed ten pounds avoirdupois each.'

"The intrepidity of character, mentioned above, may be farther illustrated by the following fact, which occurred a few years ago near Great Egg Harbour, New Jersey. A woman, who happened to be weeding in the garden, had set her child down near, to amuse itself, while she was at work; when a sudden scream from the child alarmed her, and, starting up, she beheld the infant thrown down, and dragged some few feet, and a large bald eagle bearing off a fragment of its frock; which, being the only part seized and

giving way, providentially saved the life of the infant.

"The appetite of the bald eagle, though habituated to long fasting, is of the most voracious and often the most indelicate kind. Fish, when he can obtain them, are preferred to all other fare. Young lambs and pigs are dainty morsels, and made free with on all favourable occasions. Ducks, geese, gulls, and other sea fowl, are also seized with avidity. The most putrid carrion, when nothing better can be had, is acceptable; and the collected groups of gormandizing vultures, on the approach of this dignified personage instantly disperse, and make way for their master waiting his departure in sullen silence, and at a respectful distance, on the adjacent trees.

"In one of those partial migrations of tree squirrels that sometimes take place in our western forests, many thousands of them were drowned in attempting to cross the Ohio; and, at a certain place, not far from Wheeling, a prodigious number of their dead bodies were floated to the shore by an eddy. Here the vultures assembled in great force, and had regaled themselves for some time, when a bald eagle made his appearance, and took sole possession of the premises, keeping the whole vultures at their proper distance for several days. He has also been seen navigating the same river on a floating carrion, though scarcely raised above the surface of the water, and tugging at the carcase, regardless of snags, sawyers, planters, or shallows. He sometimes carries his tyranny to great extremes against the vultures. In hard times, when food happens to be scarce, should he accidentally meet with one of these who has its craw crammed with carrion, he attacks it fiercely in the air; the cowardly vulture instantly disgorges, and the delicious contents are snatched up by the eagle before they reach the ground.

"The nest of this species is generally fixed on a very large and lofty tree, often in a swamp or morass, and difficult to be ascended. On some noted tree of this description, often a pine, or cypress, the bald eagle builds, year after year, for a long series of years. When both male and female have been shot from the nest, another pair has soon after taken possession. The nest is large, being added and repaired every season, until it becomes a black prominent mass, observable at a considerable distance. It is formed of large sticks, sods, earthy rubbish, hay, moss, &c. Many have stated that the female lays first a single egg, and that after having sat upon it some time, she lays another; when the first is hatched, the warmth of that, it is pretended, hatches the other. Whether this be correct or not, I cannot determine; but a very respectable gentleman of Virginia assured me that he saw a large tree cut down, containing the nest of a bald eagle, in which were two young, one of which appeared three times as large as the other. As a proof of their attachment to their young, a person near Norfolk informed me that in clearing a piece of wood on his place, they met with a large dead pine tree, on which was a bald eagle's nest and young. The tree being on fire more than half way up, and the flames rapidly ascending, the parent eagle darted around and among the flames, until her plumage was so much injured, that it was with difficulty she could make her escape, and even then, she several times attempted to return to relieve her offspring.

"No bird provides more abundantly for its young than the bald eagle. Fish are daily carried thither

in numbers, so that they sometimes lie scattered round the tree, and the putrid smell of the nest may be distinguished at the distance of several hundred yards. The young are at first covered with a thick whitish or cream-coloured cottony down; they gradually become of a grey colour as their plumage develops itself, continue of the brown grey until the third year, when the white begins to make its appearance on the head, neck, tail-coverts, and tail; these by the end of the fourth year are completely white, or very slightly tinged with cream; the eye, also, is at first hazel, but gradually brightens into a brilliant straw colour, with the white plumage of the head. Such, indeed, was the gradual progress of this change, witnessed by myself on a very fine specimen brought up by a gentleman, a friend of mine, who, for a considerable time, believed it to be what is usually called the grey eagle, and was much surprised at the gradual metamorphosis. This will account for the circumstance, so frequently observed, of the grey and white-headed eagle being seen together, both being, in fact, the same species, in different stages of colour, according to their difference of age.

"The flight of the bald eagle, when taken into consideration with the ardour and energy of his character, is noble and interesting. Sometimes the human eye can just discern him, like a minute speck, moving in slow curvatures along the face of the heavens, as if reconnoitering the earth at that immense distance. Sometimes he glides along in a direct horizontal line, at a vast height, with expanded and unmoving wings, till he gradually disappears in the distant blue ether. Seen gliding in easy circles over the high shores and mountainous cliffs that tower above the Hudson and Susquehannah, he attracts the eye of the intelligent voyager, and adds great interest to the scenery. At the great cataract of Niagara, already mentioned, there rises from the gulf into which the Falls of the Horse-shoe descend, a stupendous column of smoke, or spray, reaching to the heavens, and moving off in large black clouds, according to the direction of the wind, forming a very striking and majestic appearance. The eagles are here seen sailing about, sometimes losing themselves in this thick column, and again reappearing in another place, with such ease and elegance of motion, as renders the whole truly sublime.—

High o'er the watery uproar, silent seen,
Sailing sedate in majesty serene,
Now 'midst the pillar'd spray sublimely lost,
And now, emerging, down the Rapids tost,
Glides the bald eagle, gazing, calm and slow,
O'er all the horrors of the scene below;
Intent alone to sate himself with blood,
From the torn victims of the raging flood.

"The white-headed eagle is three feet long, and seven feet in extent; the bill is of a rich yellow; cere the same, slightly tinged with green; mouth flesh-coloured, tip of the tongue, bluish black; the head, chief part of the neck, vent, tail-coverts, and tail, are white in the perfect or old birds of both sexes,—in those under three years of age, these parts are of a grey brown; the rest of the plumage is deep dark brown, each feather tipped with pale brown, lightest on the shoulder of the wing, and darkest towards its extremities. The conformation of the wing is admirably adapted for the support of so large a bird; it measures two feet in breadth on the greater quills, and sixteen inches on the lesser; the longest primaries are twenty inches in length, and upwards of one inch

in circumference where they enter the skin; the broadest secondaries are three inches in breadth across the vane; the scapulars are very large and broad, spreading from the back to the wing, to prevent the air from passing through; another range of broad flat feathers, from three to ten inches in length, also extend from the lower part of the breast to the wing below, for the same purpose; between these lies a deep triangular cavity; the thighs are remarkably thick, strong and muscular, covered with long feathers pointing backwards, usually called the femoral feathers; the legs, which are covered half way below the knee, before, with dark brown downy feathers, are of a rich yellow, the colour of ripe Indian corn; feet the same; claws blue black, very large and strong, particularly the inner ones, which are considerably the largest; soles, very rough and warty; the eye is sunk under a bony, or cartilaginous projection, of a pale yellow colour, and is turned considerably forwards, not standing parallel with the cheeks; the iris is of a bright straw colour, pupil black.

"The male is generally two or three inches shorter than the female; the white on the head, neck, and tail being more tinged with yellowish, and its whole appearance less formidable; the brown plumage is also lighter, and the bird itself less daring than the female,—a circumstance common to almost all birds of prey.

"The bird from which the foregoing description was taken, was shot near Great Egg Harbour, in the month of January. It was in excellent order, and weighed about eleven pounds. Dr. Samuel B. Smith, of this city, obliged me with a minute and careful dissection of it; from whose copious and very interesting notes on the subject, I shall extract such remarks as are suited to the general reader.

"The eagle you sent me for dissection was a beautiful female. It had two expansions of the gullet. The first principally composed of longitudinal bundles of fibre, in which (as the bird is ravenous and without teeth) large portions of unmasticated meats are suffered to dissolve before they pass to the lower or proper stomach, which is membranous. I did not receive the bird time enough to ascertain whether any chylefaction was effected by the juices from the vessels of this enlargement of the œsophagus. I think it probable that it also has a regurgitating, or vomiting power, as the bird constantly swallows large quantities of indigestible substances, such as quills, hairs, &c. In this case of the eagle, I found the quill-feathers of the small white gull; and in the true stomach the tail and some of the breast feathers of the same bird, and the dorsal vertebræ of a large fish. This excited some surprise, until you made me acquainted with the fact of its watching the fish-hawks, and robbing them of their prey. Thus we see, throughout the whole empire of animal life, power is almost always in a state of hostility to justice; and of the Deity only can it be truly said that *justice* is commensurate with *power*!

"The eagle has the several auxiliaries to digestion and assimilation in common with man. The liver was unusually large in your specimen. It secretes bile, which stimulates the intestines, prepares the chyle for blood, and by this very secretion of bile (as it is a deeply respiring animal), separates or removes some obnoxious principles from the blood. (See Dr. Rush's admirable lecture on this important viscus in the human subject.) The intestines were also large,

long, convolute, and supplied with numerous lacteal vessels, which differ little from those of man, except in colour, which was transparent. The kidneys were large, and seated on each side the vertebræ, near the anus. They are also destined to secrete some offensive principles from the blood.

"The eggs were small and numerous, and, after a careful examination, I concluded that no sensible increase takes place in them till the *particular* season. This may account for the unusual excitement which prevails in these birds in the sexual intercourse. Why there are so many eggs is a mystery. It is, perhaps, consistent with natural law that everything should be abundant; but, from this bird, it is said no more than two young are hatched in a season, consequently no more eggs are wanted than a sufficiency to produce that effect. Are the eggs numbered originally, and is there no increase of number, but a gradual loss, till all are deposited? If so, the number may correspond to the long life and vigorous health of this noble bird. Why there are but two young in the season is easily explained. Nature has been studiously parsimonious of her physical strength, from whence the tribes of animals incapable to resist derive security and confidence.

"The eagle is said to live to a great age—sixty, eighty, and, as some assert, one hundred years. This circumstance is remarkable, when we consider the seeming intemperate habits of the bird—sometimes fasting, through necessity, for several days, and at other times gorging itself with animal food till its craw swells out the plumage of that part, forming a large protuberance on the breast. This, however, is its natural food, and for these habits its whole organisation is particularly adapted. It has not, like man, invented rich wines, ardent spirits, and a thousand artificial poisons, in the form of soups, sauces, and sweetmeats. Its food is simple, it indulges freely, uses great exercise, breathes the purest air, is healthy, vigorous, and long-lived. The lords of the creation themselves might derive some useful hints from these facts, were they not already, in general, too wise or too proud to learn from their *inferiors*, the fowls of the air and the beasts of the field."

As has been the case both with the golden and the white-tailed eagle of the eastern continent, this American species has, in consequence of the difference in colour between the young and the mature birds, and the length of time which the former colour lasts, been regarded and described as two species, the ossifrage when young, and the white-headed eagle when old. The confusion has been still farther increased by the same name having been given to the young of the sea-eagle of Europe; and thus, while two species have been multiplied into four, the two proper ones have been confounded with each other. Indeed, we are still in want of information respecting the birds of prey in that part of North America, especially, which lies between the valley of the Mississippi and the Rocky Mountains.

THE OSPREY (*Aquila haliaeta*). This is the proper fishing-eagle of the European shores, and also the fishing-hawk of America, which is so well described by Wilson. It has also been described as a buzzard, and named the bald buzzard, from the white upon the head. It is smaller than the eagles which we have described in the former part of this article, and it is also much more aquatic in its habits, but still its

general characters are those of an eagle, and its size and strength, though the latter is by no means so efficient on land as many of the hawks and falcons, entitle it to the same epithet.

The length of the osprey is about two feet, and the extent of its wings not less than five feet and a half, so that it is better winged in proportion than even the most powerful of the falcens, and may rank among the most aerial of all the birds of prey. The beak of this bird is powerfully formed, very much bent at the tip, furnished with a rudiment of a tooth, and of that dark colour which is always an indication of strength in this order of birds. The tarsi are, like those of the true eagles, very short and strong, but, instead of being feathered as in these, they are covered with reticulated scales, and thus bear some resemblance to those of the wading birds. The claws are very large, more especially that on the outer toe, which is reversible. They are, however, without any ridges or grooves on their under sides, and thus they are clutching claws, and not tearing ones.

The cere, the tarsi, and the toes of the osprey, are greyish blue, the under parts of the toes being abundantly furnished with pads or tubercles. The irides are yellow. The prevailing colour on the upper part is blackish brown, with the exception of the hind part of the head, and part of the neck, which is whitish. A streak of deep brown passes down each side of the neck; and the chin and fore part of the neck are streaked with the same colour, passing into lighter on the breast. The rest of the under part is dull white, passing into pale grey on the vent and tail. The coverts are pale brown, and the quills darker; sometimes relieved with a paler tint on the margins of the feathers, but never possessing any of the rich and warm browns of the land eagles. Three feathers in the middle of the tail are brown, and all the others have white bars on their inner webs. The outer tail-feathers, and first quills of the wings, have their webs very narrow and exceedingly stiff, so that they cannot be ruffled but with the greatest difficulty. The under sides of the wings, and the whole of their marginal parts, as also the plumage on the under parts of the body, are remarkably close and compact, and do not suffer the least injury by being immersed in water. The thighs are feathered down to the articulations of the tarsi; their colour is pure white; but the feathers bear more resemblance to the hair of aquatic animals, than to the feathers of ordinary birds. The young birds have their colours more broken than the old ones; and in very mature age the colours may be stated as being uniform brown on all the upper part except the head, and white on the under part.

In the places which it frequents, this bird is, perhaps, more on the wing than any of the other eagles, but it is always found over the waters; and so far as is known, it commits no depredations on land. It makes its nest in the crevices of rocks, or on the tops of tall trees, and occasionally on the ground among reeds, laying from two to four white eggs, spotted with reddish, rather smaller than those of the domestic hen. Colonel Montagu once saw a nest belonging to a pair of this species, on the top of a ruined chimney on an island in Loch Lomond. It was large and flat, formed of sticks laid across, lined with flags, and resting on the sides of the chimney. From an expression which occurs in some old acts of parliament, there is reason to believe that the bald buzzard was once trained to fishing in England. It is now

rarely met with in this country, residing chiefly near water, especially large rivers and lakes, and feeding principally on fish, which it catches with great eagerness, and on which it pounces with astonishing rapidity, sometimes plunging two feet under the surface of the water, carrying off its captive, and devouring it at leisure at some distance. In the breeding season, it is frequently seen about the Lake of Killarney, in Ireland. It is found in most of the countries of Europe, from Sweden to Greece, and is very common in Siberia, where the inhabitants foolishly believe that a single scratch of its talons is highly poisonous. It has been, moreover, ascertained to inhabit Egypt, Nigritia, Barbary, and Louisiana.—These birds are almost always observed in pairs, except during the prevalence of severe frost, when the waters are congealed, and when they usually separate in quest of milder skies. During the spring and summer months, the bald buzzard frequently is seen hovering over the large rivers in America, or resting on the wing for several minutes at a time, then suddenly darting down and seldom emerging without a fish in its talons. It then shakes off the water, like a mist, and shapes its course to the woods. The following is Wilson's very graphic description of this bird as it appears on the American waters, where, from the deep embayment of the shores, and the vast extent of broad waters, it is a highly interesting bird. "The fish-hawk is migratory, arriving on the coasts of New York and New Jersey, about the twenty-second of September. Heavy equinoctial storms may vary these periods of arrival and departure a few days, but long observation has ascertained that they are kept with remarkable regularity. On the arrival of these birds in the northern parts of the United States, in March, they sometimes find the bays and ponds frozen, and experience a difficulty in procuring fish for many days. Yet there is no instance on record of their attacking birds, or inferior land animals, with intent to feed on them; though their great strength of flight, as well as of feet and claws, would seem to render this no difficult matter. But they no sooner arrive, than they wage war on the bald eagles, as against a horde of robbers and banditti; sometimes succeeding, by force of numbers and perseverance, in driving them from their haunts, but seldom or never attacking them in single combat.

"The first appearance of the fish-hawk in spring, is welcomed by the fishermen, as the happy signal of the approach of those vast shoals of herring, shad, &c. that regularly arrive on our coasts, and enter our rivers in such prodigious multitudes. Two of a trade, it is said, seldom agree; the adage, however, will not hold good in the present case, for such is the respect paid the fish-hawk, not only by this class of men, but generally by the whole neighbourhood where it resides, that a person who should attempt to shoot one of them, would stand a fair chance of being insulted. This prepossession in favour of the fish-hawk is honourable to their feelings. They associate with its first appearance, ideas of plenty, and all the gaiety of business; they see it active and industrious like themselves; inoffensive to the productions of their farms; building with confidence, and without the least disposition to concealment, in the middle of their fields, and along their fences; and returning, year after year, regularly to its former abode.

"The nest of the fish-hawk is usually built on the top of a dead or decaying tree, sometimes not more

than fifteen, often upwards of fifty, feet from the ground. It has been remarked by the people of the sea coasts, that the most thriving tree will die in a few years after being taken possession of by the fish-hawk. This is attributed to the fish-oil, and to the excrements of the bird; but is more probably occasioned by the large heap of wet salt materials of which the nest is usually composed. In my late excursions to the sea shore, I ascended to several of these nests, that had been built in from year to year, and found them constructed as follows:—Externally, large sticks, from half an inch to an inch and a half in diameter, and two or three feet in length, piled to the height of four or five feet, and from two to three feet in breadth; these were intermixed with corn stalks, sea-weed, pieces of wet turf, in large quantities, mullein stalks, and lined with dry sea-grass; the whole forming a mass very observable at half a mile's distance, and large enough to fill a cart, and form no inconsiderable load for a horse. These materials are so well put together, as often to adhere, in large fragments, after being blown down by the wind. About the first of May, the female fish-hawk begins to lay her eggs, which are commonly three in number, sometimes only two, and rarely four. They are somewhat larger than those of the common hen, and nearly of the same shape. The ground colour varies, in different eggs, from a reddish cream, to nearly a white, splashed and daubed all over with dark Spanish brown, as if done by art. During the time the female is sitting, the male frequently supplies her with fish; though she occasionally takes a short circuit to sea herself, but quickly returns again. The attention of the male, on such occasions, is regulated by the circumstances of the case. A pair of these birds on the south side of Great Egg Harbour river, and near its mouth, were noted for several years. The female, having but one leg, was regularly furnished, while sitting, with fish in such abundance, that she seldom left the nest, and never to seek for food. This kindness was continued both before and after incubation. Some animals who claim the name and rationality of man, might blush at the recital of this fact.

"On the appearance of the young, which is usually about the last of June, the zeal and watchfulness of the parents are extreme. They stand guard, and go off to fish, alternately; one parent being always within a short distance of the nest. On the near approach of any person, the hawk utters a plaintive whistling note, which becomes shriller as she takes to wing, and sails around, sometimes making a rapid descent, as if aiming directly for you; but checking her course, and sweeping past, at a short distance over head, her wings making a loud whizzing in the air. My worthy friend, Mr. Gardiner, informs me, that they have even been known to fix their claws in a negro's head, who was attempting to climb to their nest; and I had lately a proof of their daring spirit in this way, through the kindness of a friend, resident for a few weeks at Great Egg Harbour. I had requested of him the favour to transmit me, if possible, a live fish-hawk, for the purpose of making a drawing of it, which commission he very faithfully executed; and I think I cannot better illustrate this part of the bird's character than by quoting his letter at large.—Beasley's, Great Egg Harbour, 30th June, 1811. Sir—Mr. Beasley and I went to reconnoitre a fish-hawk's nest on Thursday afternoon. When I was at the nest, I was struck with so great violence on the crown of the hat, that I

thought a hole was made in it. I had ascended fearlessly, and never dreamt of being attacked. I came down quickly. There were in the nest three young ones, about the size of pullets, which, though full-feathered, were unable to fly. On Friday morning, I went again to the nest to get a young one, which I thought I could nurse to a considerable growth, sufficient to answer your purpose, if I should fail to procure an old one, which was represented to me as almost impossible, on account of his shyness, and the danger from his dreadful claws. On taking a young one, I intended to lay a couple of snares in the nest, for which purpose I had a strong cord in my pocket. The old birds were on the tree when Captain H. and I approached it. As a defence, profiting by the experience of yesterday, I took a walking-stick with me. When I was about half way up the tree, the bird I send you struck at me repeatedly with violence; he flew round in a small circle, darting at me at every circuit, and I striking at him. Observing that he always described a circle in the air, before he came at me, I kept a *hawk's eye* upon him, and the moment he passed me, I availed myself of the opportunity to ascend. When immediately under the nest, I hesitated at the formidable opposition I met, as his rage appeared to increase with my presumption in invading his premises. But I mounted to the nest. At that moment he darted directly at me with all his force, whizzing through the air, his choler apparently redoubled. Fortunately for me, I struck him on the extreme joint of the right wing, with my stick, which brought him to the ground. During this contest, the female was flying round and round at a respectful distance. Captain H. held him till I tied his legs together with my handkerchief; the captain felt the effect of his claws. I brought away a young one to keep the old one in a good humour. I put them in a very large coop; the young one ate some fish, when broken and put into its throat; but the old one would not eat for two days. He continued sullen and obstinate, hardly changing his position. He walks about now, and is approached without danger. He takes very little notice of the young one. A Joseph Smith, working in the field where this nest is, had the curiosity to go up to look at the eggs: the bird clawed his face in a shocking manner; his eye had a narrow escape; I am told that it has never been considered dangerous to approach a hawk's nest. If this be so, this bird's character is peculiar; his affection for his young, and his valiant opposition to an invasion of his nest, entitle him to conspicuous notice. He is the *prince* of fish-hawks: his character and his portrait seem worthy of being handed to the historic muse. A hawk more worthy of the honour which awaits him could not have been found. I hope no accident will happen to him, and that he may fully answer your purpose.—Your's, Thomas Smith. . . . This morning the female was flying to and fro, making a mournful noise.

"The young of the fish-hawk are remarkable for remaining long in the nest before they attempt to fly. Mr. Smith's letter is dated June 30th, at which time, he observes, they were as large as pullets, and full feathered. Seventeen days after I myself ascended to the same hawk's nest, where I found the two remaining young ones seemingly full grown. They made no attempt to fly, though they both placed themselves in a stern posture of defence as I examined them at my leisure. The female had procured a

second helpmate; but he did not seem to inherit the spirit of his predecessor, for, like a true step-father, he left the nest at my approach, and sailed about at a safe distance with his mate, who showed great anxiety and distress during the whole of my visit. It is universally asserted, by the people of the neighbourhood where these birds breed, that the young remain so long, before they fly, that the parents are obliged at last to compel them to shift for themselves, beating them with their wings, and driving them from the nest; but that they continue to assist them even after this, I know to be a fact, from my own observation, as I have seen the young bird meet its parent in the air, and receive from him the fish he carried in his claws. The flight of the fish-hawk, his manœuvres while in search of fish, and his manner of seizing his prey, are deserving of particular notice. On leaving the nest, he usually flies direct till he comes to the sea, then sails around, in easy curving lines, turning sometimes in the air as on a pivot, apparently without the least exertion, rarely moving the wings, his legs extended in a straight line behind, and his remarkable length, and curvature or bend of wing, distinguishing him from all other hawks. The height at which he thus elegantly glides is various, from one hundred to one hundred and fifty and two hundred feet, sometimes much higher, all the while calmly reconnoitering the face of the deep below. Suddenly he is seen to check his course, as if struck by a particular object, which he seems to survey for a few moments with such steadiness, that he appears fixed in air, flapping his wings. This object, however, he abandons, or rather, the fish he had in his eye has disappeared, and he is again seen sailing around as before. Now, his attention is again arrested, and he descends with great rapidity, but, ere he reaches the surface, shoots off on another course, as if ashamed that another victim had escaped him. He now sails at a short height above the surface, and, by a zig-zag descent, and without seeming to dip his feet in the water, seizes a fish, which, after carrying a short distance, he probably drops, or yields up to the bald eagle, and again ascends, by easy spiral circles, to the higher regions of the air, where he glides about in all the ease and majesty of his species. At once, from this sublime and aerial height, he descends like a perpendicular torrent, plunging into the sea with a loud rushing sound, and with the certainty of a rifle. In a few moments he emerges, bearing in his claws his struggling prey, which he always carries head foremost, and, having risen a few feet above the surface, shakes himself as a water-spaniel would do, and directs his heavy and laborious course directly for the land. If the wind blow hard, and his nest lie in the quarter from whence it comes, it is amusing to observe with what judgment and exertion he beats to windward, not in a direct line, that is, *in the wind's eye*, but making several successive tacks to gain his purpose. This will appear the more striking, when we consider the size of the fish which he sometimes bears along. A shad was taken from a fish-hawk near Great Egg Harbour, on which he had begun to regale himself, and had already ate a considerable portion of it; the remainder weighed six pounds. Another fish-hawk was passing Mr. Beasley's, at the same place, with a large flounder in his grasp, which struggled and shook him so, that he dropped it on the shore. The flounder was picked up, and served the whole family for dinner. It is a singular fact, that the hawk

never descends to pick up a fish which he happens to drop either on the land or on the water. There is a kind of abstemious dignity in this habit of the hawk superior to the gluttonous voracity displayed by most other birds of prey, particularly by the bald eagle, whose piratical robberies committed on the present species have been already fully detailed in treating of his history. The hawk, however, in his fishing pursuits, sometimes mistakes his mark, or overrates his strength, by striking fish too large and powerful for him to manage, by whom he is suddenly dragged under; and though he sometimes succeeds in extricating himself, after being taken three or four times down, yet oftener both parties perish. The bodies of sturgeon, and of several other large fish, with a fish-hawk fast grappled in them, have at various times been found dead on the shore, cast up by the waves.

"The fish-hawk is doubtless the most numerous of all its genus within the United States. It penetrates far into the interior of the country up our large rivers and their head waters. It may be said to line the sea coast from Georgia to Canada. In some parts I have counted, at one view, more than twenty of their nests within half a mile. Mr. Gardiner informs me that, on the small island on which he resides, there are at least 'three hundred nests of fish-hawks that have young, which, on an average, consume probably not less than six hundred fish daily.' Before they depart in the autumn, they regularly repair their nests, carrying up sticks, sods, &c., fortifying them against the violence of the winter storms, which, from this circumstance, they would seem to foresee and expect. But notwithstanding all their precautions, they frequently, on their return in spring, find them lying in ruins around the roots of the tree which itself has shared the same fate. When a number of hawks, to the amount of twenty or upwards, collect together on one tree, making a loud squeeling noise, there is generally a nest built soon after on the same tree. Probably this congressional assembly were settling the right of the new pair to the premises; or it might be a kind of wedding, or joyous festive meeting on the occasion. They are naturally of a mild and peaceable disposition, living together in great peace and harmony; for though with them, as in the best regulated communities, instances of attack and robbery occur among themselves, yet these instances are extremely rare. Mr. Gardiner observes, that they are sometimes seen high in the air, sailing and cutting strange gambols, with loud vociferations, darting down several hundred feet perpendicular, frequently with part of a fish in one claw, which they seem proud of, and to claim *high hook* as the fishermen call him who takes the greatest number. On these occasions, they serve as a barometer to foretell the changes of the atmosphere; for when the fish-hawks are seen thus sailing high in the air, in circles, it is universally believed to prognosticate a change of weather, often a thunder-storm, in a few hours. On the faith of the certainty of these signs, the experienced coaster wisely prepares for the expected storm, and he is rarely mistaken.

"There is one singular trait in the character of this bird, which is mentioned in treating of the purple grackle, and which I have had many opportunities of witnessing. The grackles, or crow blackbirds, are permitted by the fish-hawk to build their nests among the interstices of the sticks of which his own is constructed, several pairs of grackles taking up their abode there, like humble vassals around the castle of

their chief, laying, hatching their young, and living together in mutual harmony. I have found no less than four of these nests clustered around the sides of the former, and a fifth fixed on the nearest branch of the adjoining tree; as if the proprietor of this last, unable to find an unoccupied corner on the premises, had been anxious to share, as much as possible, the company and protection of this generous bird.

"The fish-hawk is twenty-two inches in length, and five feet three inches in extent; the bill is deep black, the upper as well as the lower cere (for the base of the lower mandible has a loose moveable skin) and also the sides of the mouth, from the nostrils backwards, are light blue; crown and hind part of the head pure white, front streaked with brown; through the eye, a bar of dark blackish brown passes to the neck behind, which, as well as the whole upper parts, is deep brown, the edges of the feathers lighter; shafts of the wing quills brownish white; tail slightly rounded, of rather a paler brown than the body, crossed with eight bars of very dark brown; the wings, when shut, extend about an inch beyond the tail, and are nearly black towards the tips; the inner vanes of both quill and tail feathers are whitish barred with brown; whole lower parts pure white, except the thighs, which are covered with short plumage, and streaked down the fore part with pale brown; the legs and feet are a very pale light blue, prodigiously strong, and disproportionally large, and are covered with flat scales of remarkable strength and thickness, resembling, when dry, the teeth of a large rasp, particularly on the soles, intended, no doubt, to enable the bird to seize with more security his slippery prey; the thighs are long, the legs short, feathered a little below the knee, and, as well as the feet and claws, large; the latter hooked into semicircles, black, and very sharp pointed; the iris of the eye a fiery yellow orange.

"The female is fully two inches longer; the upper part of the head of a less pure white, and the brown streaks on the front spreading more over the crown. The throat and upper part of the breast are dashed with large blotches of pale brown, and the brown bar across the eye is less deep in the tint. The toes of both are exceedingly strong, and much tuberculated; and the claw on the hind toe is an inch and a quarter in measure. The feathers on the hind part of the head are long and narrow, and erected when the bird is excited, as is the case in the land eagles. The eye is without the projecting bony socket, which is common to most of the birds of prey; and the nostrils are very large, triangular, and curved. The two glands on the rump, which supply the bird with oil for lubricating the feathers, are very large, and the contents is a fatty matter, bearing some resemblance in consistency to hog's lard." Thus far we have quoted Wilson's description of this very interesting bird,—a bird which is, perhaps, more characteristic of the American waters than any other which is found on the shores and recesses of that country, which is peculiarly the land of lakes and streams; and where, in consequence, the inhabitants of the waters are of peculiar interest.

Though there are some slight differences between the descriptions of Wilson and the other American describers, and those of the European naturalists that have described this bird as the osprey of our shores, there seems little doubt of the perfect identity of the species in both continents. In Europe, indeed, the bird is said to build less habitually in trees than it

does in America; but that does not form any foundation for a specific difference, as many of the ducks and other aquatic birds which build upon trees in America, build in reeds and bushes in Europe.

THE GREAT AMERICAN EAGLE (*Falco Washingtonii* of Audobon). We mention this species upon the authority of the naturalist whose name we have mentioned, though, at the same time, we have some doubts whether the one which he describes may not be the sea-eagle in its young plumage, or perhaps the harpy eagle, which belongs more to the central latitudes of America, and is one of the short-winged fishing-eagles. The description given by Audobon certainly is that of a very different bird; and, in order that we may do justice both to him and to his subject, we shall quote the entire passage. "It was," says Audobon, "in the month of February, 1814, that I obtained the first sight of this noble bird, and never shall I forget the delight which it gave me. Not even Herschel, when he discovered the planet which bears his name, could have experienced more rapturous feelings. We were on a trading voyage, ascending the Upper Mississippi. The keen wintry blasts whistled around us, and the cold from which I suffered had, in a great degree, extinguished the deep interest which, at other seasons, this magnificent river has been wont to awake in me. I lay stretched beside our patroon. The safety of our cargo was forgotten, and the only thing that called my attention was the multitude of ducks, of different species, accompanied by vast flocks of swans, which from time to time passed us. My patroon, a Canadian, had been engaged many years in the fur trade. He was a man of much intelligence; and, perceiving that these birds had engaged my curiosity, seemed anxious to find some new object to divert me. An eagle flew over us. 'How fortunate!' he exclaimed; 'this is what I could have wished. Look, sir! the great eagle, and the only one I have seen since I left the lakes.' I was instantly on my feet, and, having observed it attentively, concluded, as I lost it in the distance, that it was a species quite new to me. My patroon assured me that such birds were indeed rare; that they sometimes followed the hunters, to feed on the entrails of animals which they had killed, when the lakes were frozen over, but that, when the lakes were open, they would dive in the day-time after fish, and snatch them up in the manner of the fishing-hawk, and that they roosted generally on the shelves of the rocks, where they built their nests, of which he had discovered several by the quantity of white dung scattered below.

"Convinced that the bird was unknown to naturalists, I felt particularly anxious to learn its habits, and to discover in what particulars it differed from the rest of its genus. My next meeting with this bird was a few years afterwards, whilst engaged in collecting cray-fish on one of those flats which border and divide Green River, in Kentucky, near its junction with the Ohio. The river is there bordered by a range of high cliffs, which, for some distance, follow its windings. I observed on the rocks, which, at that place, are nearly perpendicular, a quantity of white ordure, which I attributed to owls that might have resorted thither. I mentioned the circumstance to my companions, when one of them, who lived within a mile of the place, told me it was from the nest of the brown eagle, meaning the white-headed eagle (*Falco leucocephalus*), in its immature state. I

assured him this could not be, and remarked, that neither the old nor the young birds of that species ever build in such places, but always in trees. Although he could not answer my objection, he stoutly maintained that a brown eagle of some kind, above the usual size, had built there; and added, that he had espied the nest some days before, and had seen one of the old birds dive and catch a fish. This he thought strange, having, till then, always observed that both brown eagles and bald eagles procured this kind of food by robbing the fish-hawks. He said, that if I felt particularly anxious to know what nest it was, I might soon satisfy myself, as the old birds would come and feed their young with fish, for he had seen them do so before.

"In high expectation, I seated myself at about a hundred yards from the foot of the rock. Never did time pass more slowly. I could not help betraying the most impatient curiosity, for my hopes whispered it was a sea eagle's nest. Two long hours had elapsed before the old bird made his appearance, which was announced to us by the loud hissings of the two young ones, which crawled to the extremity of the hole to receive a fine fish. I had a perfect view of this noble bird as he held himself to the edging rock, hanging like the barn, bank, or social swallow, his tail spread, and his wings partly so. I trembled lest a word should escape from my companions. The slightest murmur had been treason from them. They entered into my feelings, and, although little interested, gazed with me. In a few minutes the other parent joined the mate, and, from the difference in size (the female of rapacious birds being much larger), we knew this to be the mother bird. She also had brought a fish: but, more cautious than her mate, she glanced her quick and piercing eye around, and instantly perceived that her abode had been discovered. She dropped her prey, with a loud shriek communicated the alarm to the male, and, hovering with him over our heads, kept up a growling cry, to intimidate us from our suspected design. This watchful solicitude I have ever found peculiar to the female,—must I be understood to speak only of birds?

"The young having concealed themselves, we went and picked up the fish which the mother had let fall. It was a white perch, weighing about five pounds and a half. The upper part of the head was broken in, and the back torn by the talons of the eagle. We had plainly seen her bearing it in the manner of the fish-hawk.

"This day's sport being at an end, as we journeyed homewards, we agreed to return the next morning, with the view of obtaining both the old and young birds; but rainy and tempestuous weather setting in, it became necessary to defer the expedition till the third day following, when, with guns and men all in readiness, we reached the rock. Some posted themselves at the foot, others upon it, but in vain. We passed the entire day, without either seeing or hearing an eagle, the sagacious birds, no doubt, having anticipated an invasion, and removed their young to new quarters.

"I come at last to the day which I had so often and so ardently desired. Two years had gone by since the discovery of the nest, in fruitless excursions; but my wishes were no longer to remain ungratified. In returning from the little village of Henderson, to the house of Dr. Rankin, about a mile distant, I saw an eagle rise from a small enclosure not a hundred

yards before me, where the doctor had, a few days before, slaughtered some hogs, and alight upon a low tree branching over the road. I prepared my double-barrelled piece, which I constantly carry, and went slowly and cautiously towards him. Quite fearlessly he waited my approach, looking upon me with undaunted eye. I fired, and he fell. Before I reached him, he was dead. With what delight did I survey the magnificent bird! Had the finest salmon ever pleased him as he did me? Never. I ran and presented him to my friend, with a pride which they alone can feel who, like me, have devoted themselves from their earliest childhood to such pursuits, and who have derived from them their first pleasures. To others I must seem to prattle out of fashion. The doctor, who was an experienced hunter, examined the bird with much satisfaction, and frankly acknowledged he had never before seen or heard of it.

"The name which I have chosen for this new species of eagle, 'the bird of Washington,' may, by some, be considered as preposterous and unfit; but, as it is indisputably the noblest bird of its genus that has yet been discovered in the United States, I trust I shall be allowed to honour it with the name of one yet nobler, who was the saviour of his country, and whose name will ever be dear to it. To those who may be curious to know my reasons, I can only say that, as the New World gave me birth and liberty, the great man who ensured its independence is next to my heart. He had a nobility of mind, and a generosity of soul, such as are seldom possessed. He was brave, so is the eagle; like it, too, he was the terror of his foes; and his fame, extending from pole to pole, resembles the majestic soarings of the mightiest of the feathered tribe. If America has reason to be proud of her Washington, so has she to be proud of her great eagle.

"In the month of January following, I saw a pair of these eagles flying over the falls of the Ohio, one in pursuit of the other. The next day I saw them again. The female had relaxed her severity, had laid aside her coyness, and to a favourite tree they continually resorted. I pursued them unsuccessfully for several days, when they forsook the place.

"The flight of this bird is very different from that of the white-headed eagle. The former encircles a greater space whilst sailing, keeps nearer to the land and the surface of the water, and when about to dive for fish, falls in a spiral manner, as if with the intention of checking any retreating movement which its prey might attempt, darting upon it only when a few yards distant. The fish hawk often does the same. When rising with a fish, the bird of Washington flies to a considerable distance, forming, in its line of course, a very acute angle with the surface line of the water. My last opportunity of seeing this bird was on the 15th of November, 1821, a few miles above the mouth of the Ohio, when two passed over our boat, moving down the river with a gentle motion. In a letter from a kind relative, Mr. W. Blakewell, dated 'Falls of the Ohio, July 1819,' and containing particulars relative to the swallow-tailed hawk (*Falco furcatus*), that gentleman says—'Yesterday, for the first time, I had an opportunity of viewing one of those magnificent birds which you call the sea eagle, as it passed low over me, whilst fishing. I shall be really glad when I can again have the pleasure of seeing your drawing of it.'

"Whilst in Philadelphia, about twelve months ago, I had the gratification of seeing a specimen of this

eagle at Mr. Brans's museum. It was a male, in fine plumage, and beautifully preserved. I wished to purchase it, with a view to carry it to Europe, but the price put upon it was above my means."

Such is the description given by Audobon of this bird, or rather of the effects the sight of it produced on him; though, as we have before stated, there are some reasons to doubt whether this ought to be considered as a separate species. Indeed, in all those places where eagles range far over countries naturally wide and wild, there are always some difficulties attending their natural history. In North America, the eagle pasture extends from the Northern Lakes to the Gulf of Mexico, or, indeed, it may be said, all the way to South America; and in the course of so extensive a range, and where the seasons are so very variable as they are in this great valley, we may be prepared to meet many differences of appearance, and encounter no small difficulty in ascertaining with perfect correctness whether individual specimens, which are seen occasionally, at long distances from each other, and under different circumstances, be or be not the same species.

It has been alleged by some that the golden eagle, or a species somewhat allied, has been seen on the eastern slopes of the Stony Mountains; and it is not impossible that some such bird may visit this district, which is very analogous to those which the same species of eagle inhabits in Europe; but that which Audobon here describes is positively said to be a fishing eagle; and were it not for the great length of wing which he states it to possess, one would be not a little inclined to regard it as being probably an individual of the following species:—

THE HARPY EAGLE (*Harpyia destructor*). This is also a fishing eagle, and belongs to different pastures from the sea eagle, the osprey, and the other long-winged fishers. It is a very large bird; and its beak and claws, which are invariably larger in proportion as these birds have more of the fishing habit, are very formidable in appearance. The general aspect of the bird is, however, somewhat feeble, and not at all in accordance with its size; and there is a restlessness about it which is not characteristic of the more powerful eagles, the habit of which is repose, in all cases where they are not under the excitement of seeking their prey. From the figure given in the plate, EAGLES, and the following description, some judgment may be formed of the appearance, and partially, at least, of the character of this large bird. Its predatory habits are denoted by its very robust legs, and the extraordinary curvature of its beak and talons; the upper mandible suddenly curving downwards with a strong arch or hook towards the point, which is excessively sharp. By this structure, and the shortness of the wings, it is readily distinguished from the other eagles. The usual length of an adult specimen, as that in the Zoological Gardens, is three feet and a half from beak to tail. The head is covered with thick downy plumage of slaty grey, with a crest of black and grey feathers rising from the back part of the head, which the bird raises considerably when excited. The back and wings and fore part of the neck are black; the feathers of the back terminating rather lighter; from the breast backwards is pure white; and the plumage of the legs is white with blackish bars. The tail is ashy, banded with black; the beak and claws are black, and the legs, which are partly feathered, dusky yellow. Such is the description of a specimen which

was kept for some time in the gardens of the Horticultural Society of London, and afterwards transferred to the collection of the Zoological Society. No very satisfactory account of the native habits of an eagle can be procured when the bird is confined, so that instead of showing its style of flight, it has not room to spread its wings. It is probable, too, that some of the accounts given by travellers of the formidable nature of this eagle are very much exaggerated; and that its real habits are destitute of the grandeur of the eagles of the open air over the wilds, of which it certainly has none of the expression. From all that we can infer respecting the character of this eagle, we should be disposed to conclude that it combines, in part, the manners of the woodland hawks and the vultures; but as the districts over which it extends are varied and difficult to be explored, it is not easy to speak with precision respecting it. The curvature of the bill, all the way from the base, is certainly a character analogous to that of the hawks.

In the richer parts of tropical America, Africa, the East Indies, and also New Holland, there are eagles which bear some resemblance to this one in their habits; being found chiefly over or near the streams, and feeding, in part at least, upon fish. We may mention one or two of these, though they rest chiefly upon museum specimens, or at best upon individuals seen casually.

THE CARACARA EAGLE is a very common bird of prey both in Brazil and in Paraguay. It gets its name from the sound of its voice. It is a low-flying eagle, a very miscellaneous feeder, and, contrary to the habits of the more typical eagles, it comes near human dwellings, and, in part at least, picks up its food while on the ground. It cannot fly high, and walks more than birds of prey generally do. The upper part of the head is black; the neck brownish grey; the breast and shoulders of that colour, barred with brown; the other part of the plumage is blackish brown, except the tail, which is a dirty white colour, with dusky bands, and a black termination. The changes in plumage are too frequent to give the reader an accurate description. The caracara is so bold as to frequent house-tops, walking about with as little fear as the vulture; and it is said even to carry off the sportsman's game before his eyes. D'Azzara tells us that he has seen four or five of this species hunt down red buzzards and herons; and they are believed to prey upon the American ostrich, lambs, and young fawns.

THE CHILIAN SEA EAGLE. This species, though named from the western shore of South America, is found also on the east, and might, with equal propriety, be named after Brazil, or indeed almost any other part of the continent. The habit of naming birds after individual localities, from which a specimen happens to be brought, occasions no small confusion in natural history. This bird plies along the coasts of the sea and the margins of the large fresh waters, but it is a bird of much less splendour in its habits than the white-headed eagle of the north, or even the osprey. It is not so much a fisher as it is a scavenger, haunting the shores for the purpose of clearing them of the refuse of animal matter, much in the same way as the vultures do upon land. The plumage of a mature bird is greyish on the upper part, with white margins to the feathers on the back and breast, and white on the under part, with feathers on the tarsi, which are also of a whitish colour, pencilled with lines

of greyish brown. This formation of the feet indicates a bird which has not the habit of plunging into the water for the purpose of seizing its prey. We believe there are several other American species resembling



The Chilean Sea Eagle.

these more or less in their habits, but the distinctions between them are involved in much obscurity; and it does not appear that there is anything peculiarly interesting in their history, or that a more intimate acquaintance with them would contribute much to our real knowledge of the feathered race.

SOUTH AFRICAN EAGLE. This species inhabits the country about the Cape of Good Hope, but it is supposed to extend over a great part of southern Africa; indeed, over all the country to the southward of the Great Desert. It is more of a land eagle than those which have been mentioned as inhabiting South America, is subject to great changes of plumage, being tawny chestnut when young, and brown, marked with black, when old.

THE WHITISH AFRICAN EAGLE. This species, as mentioned by Le Vaillant, and some other travellers, is thus described:—Whitish, variegated above with yellowish brown, the black barred with white; back of the head slightly crested. About a third smaller than the golden eagle, and of a more slender shape; first observed in the regions of Africa that confine on the Cape of Good Hope. This eagle pursues its game with such agility that hardly any bird can outstrip it. It is partial to a sort of wood-pigeon, whose flight is also very rapid, but which rarely escapes its fangs. It likewise subsists on wood-partridges, and on a very diminutive kind of antelope, which occurs only in the forests. There, concealed behind the thick branch of a tree, this eagle watches his prey, which he seizes by rushing down on it without noise. No sooner has he accomplished the capture than all the crows in the neighbourhood flock around him to share in the spoil; but he defies alike their approach and their clamour, so that they are contented to remain under the tree on which he makes his repast, and pick up the fallen fragments. He never eats his game on the ground, but always bears it to some lofty station, and plucks off the feathers before he despatches it. "But what is very extraordinary," observes Le Vaillant, "and seems difficult of belief in a bird whose ordinary food consists of birds,

is, that the smallest of them may fly, or remain near him, with impunity, and even alight on his eyrie, for he not only does them no harm, but becomes their protector, and defends them against other birds of prey." But he suffers no ravenous bird to approach his domain, chasing and harassing it till it retires. When tranquil, and sated with food, he repeats, for hours together, a weak and shrill cry. The nest is placed on the top of the highest trees, and contains two white eggs, as large as those of the turkey hen, and rounder. The male and female perform alternately the function of incubation.

THE VOCIFEROUS, or SCREAMING EAGLE, is described in the following terms:—Rusty brown, waved with black; head, neck, breast, and tail white. This appears to be the principal fishing eagle of Southern Africa. The claw, which is slightly visible, is covered with long frizzled down. The female is stronger than the male, but less brilliant in her attire. The sexes are inseparable companions, hunting, flying, and resting together. They subsist chiefly on fish, darting down from the air with inexpressible celerity on such as they perceive, striking the surface of the water with a loud noise, and even submerging their whole body to secure their prize. They also devour a sort of large lizard which abounds in some of the African rivers, and occasionally antelopes, but never birds. Their loud and clamorous call resounds through the vast solitudes of Southern Africa. They are rare at the Cape of Good Hope, and seldom met with till about sixty or eighty leagues in the interior of the country; but the district in which they most frequently occur is about the Bay of Lagoa. Like most other eagles, they place their nest either on the top of lofty trees, or on the points of rocks, and line it with wool, feathers, &c. The eggs are shaped like those of the turkey, but larger, and also whiter.

In many parts of India there are eagles, and probably the imperial eagle of Europe may be found in that country, altered by climate, as it appears that birds of prey, contrary to the habit of the more powerful predatory mammalia, have their characters softened in the warmer countries. Many places of India, especially the Ghauts, or rocky passes which border the table land in the southern parts, are well adapted for the habits of eagles. The following figure represents what is sometimes called the Pondicherry eagle,



Pondicherry Eagle.

though it is highly probable that it ranges along the slopes of the mountains on both coasts. It is also said that there are eagles of a very large size in the eastern islands; and, from the character of the coun-

try, this is highly probable, though we are but little acquainted with the fact.

THE WEDGE-TAILED EAGLE is a native of New Holland, and is about the same proportions as the golden eagle of Europe, but of smaller size, and having the tail wedged or pointed. It is represented as preying upon the emu, and the young of the kangaroo.

EARTH NUT is the *Bunium flexuosum* of Linnaeus, and is found in woods and sometimes in pastures. It has a tuberous root, about the size of a hazel nut, of a sweetish agreeable taste, and eagerly sought for by pigs; indeed, none of the plants are to be met with where pigs are allowed to range. The *Arachis hypogæa*, a South American leguminous plant, is also called the earth nut.

EARTHQUAKE. This is the most terrific of all natural phenomena, and yet, like many other phenomena which appear to deface the fair form of nature, it in reality comes with "healing on its wings." There is no question but that these extraordinary convulsions of the earth's surface are in reality produced by volcanic powers, and that, though lava and scoria are not at once discharged into the atmosphere on the site of the earthquake, yet the best recorded accounts always speak of the great volcanic mountains being at the same time in a state of fearful agitation. Indeed, they have generally been found to precede very violent volcanic eruptions, and they serve, like them, to form vents for the escape of chemical agents, which would otherwise tend to burst asunder and entirely destroy our globe. The character of these extraordinary phenomena will, however, be best understood by furnishing a few details from eye-witnesses to their devastating effects.

The older natural historians teem with the most exaggerated accounts of earthquakes, and the miraculous interposition of relics in checking their progress. Passing, however, by these day-dreams of the earlier naturalists, we come to the great earthquake of 1750, which was felt in three quarters of the globe at once, and which, for a time, deranged the boundaries of the ocean as much as it affected the land. It commenced at Lisbon on the last day of October, and, according to historians, it began with a thick fog, which was soon dissipated by the heat of the sun. No wind was stirring; the sea was calm, and the weather as warm as in June or July in this country. At thirty-five minutes after nine, without the least warning, except a rumbling noise, a most dreadful earthquake shook, by short but quick vibrations, the foundations of all the city, so that many buildings instantly fell. Then, with a scarce perceptible pause, the nature of the motion was changed, and the houses were thrown from side to side, with a motion like that of a wagon violently driven over rough stones. This second shock "laid almost the whole city in ruins, with prodigious slaughter of the people." The earthquake lasted in all about six minutes. At the moment of its beginning, some persons on the river, near a mile from the city, heard a noise as if their vessel had run aground, though they were then in deep water; and at the same time they saw the houses falling on both sides of the river. The bed of the river Tagus was in many places raised to its surface; ships were driven from their anchors, and thrown together with great violence; nor did their commanders know

whether they were afloat or aground. A large new quay sank to an unfathomable depth, with several hundreds of people who were upon it; nor was one of the dead bodies ever found. The bar was at first seen dry from shore to shore; but suddenly the sea came "rolling in like a mountain," and about Belem Castle the water rose fifty feet almost in an instant. About noon there was another shock, when the walls of several houses that yet remained were seen to open from top to bottom more than a quarter of a yard, and afterwards closed again so exactly that scarce any mark of the injury was left.

At Colares, about twenty miles from Lisbon, and two miles from the sea, on the last day of October, the weather was clear, and uncommonly warm for the season. About four o'clock in the afternoon there arose a fog, which came from the sea, and covered the valleys, a circumstance very unusual at that season of the year. Soon after, the wind changing to the east, the fog returned to the sea, collecting itself, and becoming exceedingly thick. As the fog retired, the sea rose "with a prodigious roaring." The first of November opened with a serene sky, the wind continuing at east; but about nine o'clock the sun began to grow dim, and about half an hour after was heard a rumbling noise like that of chariots, which increased to such a degree that it became equal to the explosions of the largest cannon. Immediately a shock of an earthquake was felt, which was quickly succeeded by a second and third, and at the same time several light flames of fire issued from the mountains, resembling the kindling of charcoal. In these three shocks the walls of the buildings moved from east to west. In another situation, whence the sea-coast could be discovered, there issued from one of the hills, called the *Fojo*, a great quantity of smoke, very thick, but not very black. This still increased with the fourth shock, and afterwards continued to issue in a greater or less degree. Just as the subterraneous rumblings were heard, the smoke was observed to burst forth at the *Fojo*, and the quantity of smoke was always proportioned to the noise. On visiting the place whence the smoke was seen to arise, no signs of fire could be perceived near it.

At Oporto (near the mouth of the river Douro) the earthquake began about forty minutes past nine. The sky was very serene, when a dreadful hollow noise like thunder, or the rattling of coaches at a distance, was heard, and almost at the same instant the earth began to shake. In the space of a minute or two the river rose and fell five or six feet, and continued to do so for four hours. It ran up at first with so much violence, that it broke a ship's hawser. In some parts the river opened, and seemed to discharge vast quantities of air; and the agitation in the sea was so great, about a league beyond the bar, that air was supposed to have been discharged there also.

St. Ube's, a sea-port town about twenty miles south of Lisbon, was entirely swallowed up by the repeated shocks and the vast surf of the sea. Huge pieces of rock were detached at the same time from the promontory at the west end of the town, which consists of a chain of mountains containing fine jasper of different colours.

The same earthquake was felt all over Spain, except in Catalonia, Aragon, and Valencia.—At Ayamonte (near where the Guadiana falls into the Bay of Cadiz), a little before ten o'clock on the first of

November, the earthquake was felt; having been immediately preceded by a hollow rushing noise.—Here the shocks continued for fourteen or fifteen minutes, damaged almost all the buildings, throwing down some, and leaving others irreparably shattered. In little more than half an hour after, the sea and river, with all the canals, overflowed their banks with great violence, laying under water all the coasts of the islands adjacent to the city and its neighbourhood, and flowing into the very streets. The water came on in "vast black mountains," white with foam at the top, and demolished more than one-half of a tower at the bar named *De Canala*.

At Gibraltar, the earthquake was not felt till after ten. It began with a tremulous motion of the earth, which lasted about half a minute. Then followed a violent shock; after that, a trembling of the earth for five or six seconds; then another shock not so violent as the first, which went off gradually as it began.—The whole lasted about two minutes. Some of the guns on the battery were seen to rise, others to sink, the earth having an undulating motion. Most people were seized with giddiness and sickness, and some fell down; others were stupified; and many that were walking or riding felt no motion in the earth, but were sick. The sea rose above six feet, and then fell so low, that boats and all the small craft near the shore were left aground, as were also numbers of small fish. The flux and reflux lasted till next morning, having decreased gradually from two in the afternoon.

In Africa the earthquake was felt almost as severely as it had been in Europe. Great part of the town of Algiers was destroyed. At Arzilla (a town in the kingdom of Fez), about ten in the morning, the sea suddenly rose with such impetuosity, that it lifted up a vessel in the bay, and threw it with such force on the land, that it was broken to pieces. At Fez and Mequinez, great numbers of houses fell down, and a multitude of people were buried in the ruins.

At Morocco, by the falling down of the houses, many people lost their lives: and about eight leagues from the city, the earth opened and swallowed up a village with all the inhabitants, amounting to about ten thousand persons, together with all their cattle, &c. and soon after the earth closed again in the same manner as before. At Salle, a great deal of damage was done. Near a third part of the houses were overthrown; the waters rushed into the city with great rapidity, and left behind them great quantities of fish.

In the city of Funchal, in the island of Madeira, a shock of this earthquake was first perceived at thirty-eight minutes past nine in the morning. It was preceded by a rumbling noise in the air, like that of empty carriages passing hastily over a stone pavement. The inhabitants felt their houses move with a tremulous motion, vibrating very quickly.—The shock continued more than a minute; during which space, the vibrations, though continual, were weakened and increased in force twice very sensibly. The increase after the first remission of the shock was the most intense. The noise in the air accompanied the shock during the whole of its continuance, and lasted some seconds after the motion of the earth had ceased; dying away like a peal of distant thunder rolling through the air. At three quarters past eleven the sea, which was quite calm, it being a fine day, and no wind stirring, retired suddenly some paces; then

rising with a great swell, without the least noise, and as suddenly advancing, overflowed the shore, and entered the city. It rose fifteen feet perpendicular above the high-water mark, although the tide, which flows there seven feet, was then at half ebb. The water immediately receded; and, after having fluctuated four or five times between high and low-water mark, it subsided, and the sea remained calm as before. In the northern part of the island the inundation was more violent, the sea there retiring above one hundred paces at first, and, suddenly returning, overflowed the shore, forcing open doors, breaking down the walls of several magazines and storehouses, leaving great quantities of fish ashore and in the streets of the village of Machico. All this was the effect of one rising of the sea, for it never afterwards flowed high enough to reach the high-water mark. It continued, however, to fluctuate here much longer before it subsided than at Funchal; and in some places to the westward, it was hardly perceptible.

In many parts of Germany the effects of the earthquake were very extraordinary. Throughout the duchy of Holstein, the waters were violently agitated, particularly those of the Elbe and Trave. In Brandenburg, the waters of a large lake called Libsec ebbed and flowed six times in half an hour, with a dreadful noise, the weather being then perfectly calm. The same agitation was observed in the waters of the lakes called Muplgast and Netzo; but at this last place they also emitted an intolerable stench.

In our own island the effects of the earthquake were very perceptible, though not felt with the same terrific violence as on the continent of Europe. At Eyam Bridge, in Derbyshire, some miners who were at the bottom of a shaft about four hundred and fifty feet in depth, were thrown to another part of the gallery where they were working, and the neighbouring waters were violently agitated.

At Loch Lomond, in Scotland, the water was suddenly hurled against its banks, but immediately subsided, till it was as low in appearance as any body then present had ever seen it in the greatest summer-drought. Instantly it returned towards the shore, and in five minutes' time rose again as high as before. The greatest perpendicular height of this swell was two feet four inches. A still more remarkable phenomenon attendant on the earthquake in this lake was, that a large stone lying at some distance from the shore, was forced out of its place in the lake upon dry land, leaving a deep furrow in the ground along the way in which it had moved.

In Loch Ness, about half an hour after nine, a very great agitation was observed in the water. About ten the river Oich, which runs on the north side of Fort Augustus into the head of the loch, was observed to swell very much, and run upwards from the loch with a pretty high wave, about two or three feet higher than the ordinary surface. The motion of the wave was against the wind, and it proceeded rapidly for about 200 yards up the river. It then broke on a shallow, and flowed three or four feet on the banks, after which it returned gently to the loch. It continued ebbing and flowing in this manner for about an hour, without any such remarkable waves as the first; but about eleven o'clock, a wave higher than any of the rest came up, and broke with so much force on the low ground on the north side of the river, that it ran upon the grass upwards of thirty feet from the river's bank.

At Kinsale, between two and three in the afternoon, the weather being very calm, and the tide near full, a large body of water suddenly poured into the harbour with such rapidity, that it broke the cables of two sloops, each moored with two anchors, and of several boats lying near the town. But just at the time that a great deal of mischief was apprehended by all the vessels running foul of each other, an eddy whirled them round several times, and then hurried them back again with the same rapidity as before. This was several times repeated; and while the current rushed up at one side of the harbour, it poured down with equal violence at the other. A vessel that lay all this time in the pool did not seem to be any ways affected by it; nor was the violence of the currents much perceived in the deeper parts of the harbour, but raged with most violence on the flats. The bottom of the harbour, which is muddy, was much altered; the mud being washed from some places, and deposited in others. The perpendicular rise of the water at one quay was measured, and found to be five feet and a half; and is said to have been much higher at another, where it overflowed, and poured into the market-place with such rapidity, that some people who were on the quay immediately ran off, and yet could not prevent themselves from being overtaken and immersed knee-deep in the water. The agitations extended several miles up the river; but, as in the harbour, were most perceived in the shallowest places. The successive risings and fallings of the water continued about ten minutes, and then the tide returned to its natural course. Between six and seven in the evening, the water rose again, though not with so great violence as before, and it continued to ebb and flow alternately till three in the morning. The waters did not rise gradually at first; but, with "a hollow and horrid noise, rushed in like a deluge, rising six or seven feet in a minute, and as suddenly subsiding. They were as thick as puddle, very black, and stank intolerably." From different accounts it appeared, that the water was affected in a similar manner all along the coast to the westward of Kinsale.

Such were the phenomena of this very remarkable and destructive earthquake, which extended over an immense tract of country. The earthquakes, however, which in the year 1783 ruined a great part of Italy and Sicily, though much more confined in their extent, seem to have been not at all inferior in violence. Sir William Hamilton, who wrote a particular account of their effects, informs us, that "if, on a map of Italy, and with your compass on the scale of Italian miles you were to measure off twenty-two, and then, fixing the central point in the city of Oppido (which seemed to be the spot where the earthquake had exerted its greatest force), form a circle (the radii of which will be twenty-two miles), you will then include all the towns, villages, &c. that have been utterly ruined, and the spots where the greatest mortality happened, and where there have been the most visible alterations on the face of the earth: then extend your compass on the same scale to seventy-two miles, preserving the same centre, and form another circle, you will include the whole country that has any mark of having been affected by the earthquake. A gradation was plainly observed in the damage done to the buildings, as also in the degree of mortality, in proportion as the countries were more or less distant from this supposed centre of the evil." Another cir-

cumstance was particularly remarked, in which this earthquake differed very considerably from others, viz. that if two towns were situated at an equal distance from this centre, one on the hill, the other on the plain or in a bottom, the latter always suffered more by the shocks of the earthquakes than the former.

Sir William Hamilton, who was ambassador from this country to the court of Naples, thus describes the effects of the earthquake in that country :—" I travelled (says he) four days in the plain, in the midst of such misery as cannot be described. The force of the earthquake there was so great, that all the inhabitants of the towns were buried, alive or dead, in the ruins of their houses in an instant. The town of Polistene was large, but ill situated between two rivers that were subject to overflow. Two thousand one hundred, out of 6,000, lost their lives here on the fatal 5th of February." At Castel Nuova, the princess Gerace Grimaldi, with 4,000 of her subjects, perished on the same day by the explosion ; for such it appears to have been. Some who had been dug alive out of the ruins, told our author, that they had felt their houses fairly lifted up, without having the least previous notice. An inhabitant of Castel Nuova was at that moment on a hill overlooking the plain ; when, feeling the shock, and turning round, instead of the town, he saw only a thick cloud of white dust, like smoke, the natural effect of the crushing of the buildings and the mortar flying off.

The town of Castel Nuova was so effectually destroyed by this dreadful shock, that neither vestige of house or street remained, but all lay in one confused heap of ruins. Castillace and Milicusco, which our author next visited, were both in the same situation. Terra Nuova, situated in the same plain, stood between two rivers, which with the torrents from the mountains, had, in the course of ages, cut deep and wide chasms in the soft sandy clay soil of which it is composed. At Terra Nuova, the ravine or chasm is not less than 500 feet deep, and three quarters of a mile broad. Here the accounts of the earthquake were confused, by not having the situation of the place and nature of the soil explained. It was said, that a town had been thrown a mile from the place on which it stood, without mentioning a word of the ravine ; that woods and corn-fields had been removed in the same manner, " when in truth (says our author) it was but upon a large scale what we see every day upon a smaller ; when pieces of the sides of hollow ways, having been undermined by rain waters, are detached by their own weight. Here, from the great depth of the ravine, and the violent motion of the earth, two huge portions of the latter, on which a great part of the town stood, which consisted of some hundred houses, had been detached into the ravine, and nearly across it, at about the distance of half a mile from the place where they formerly stood ; and what is very extraordinary, many of the inhabitants who had taken this singular leap in their houses, were nevertheless dug out alive, and some unhurt." Our author's guide there, who was both a priest and physician, having been buried in the ruins of his house by the first shock, was thrown out of it and delivered by the second, which immediately followed the first ; and there were many well attested instances of the same thing having happened in different parts of Calabria. At Terra Nuova, however, only 400 out of 1600 inhabitants were left alive.

In other parts of the plain, situated near the ravine and near the town of Terra Nuova, our author saw many acres of land, with trees and corn-fields, that had been detached into the ravine, frequently without having been overturned ; so that the crops were growing as well as if they had been planted there. Other such pieces were lying in the bottom in an inclined situation ; and others again that had been quite overturned. In one place, two of these immense pieces of land having been detached, opposite to one another, had filled the valley, and stopped the course of the river, the waters of which were forming a great lake ; " and this (says our author) is the true state of what the accounts mention of mountains that had walked, and having joined together, stopped the course of a river, and formed a lake."

Having thus described two of the most remarkable earthquakes in the olden time, which are valuable from their being well authenticated, we may now briefly notice a most extraordinary natural phenomenon of this description, which occurred in 1812. The state of Missouri, which forms one of the western settlements of the United States of America, was the theatre of this catastrophe ; and we cannot do better than furnish a condensed view from the account given by Mr. Flint, in his " Recollections of the Valley of the Mississippi." This traveller, who visited the country about seven years after the event, says, that " from all the accounts corrected by one another, and compared with the very imperfect narratives which were published, I infer that the shock of these earthquakes in the immediate vicinity of the centre of their force, must have equalled, in their terrible heavings of the earth, any thing of the kind that has been recorded. I do not believe that the public have ever yet had any adequate idea of the violence of the concussions. We are accustomed to measure this by the buildings overturned, and the mortality that results. Here the country was thinly settled ; the houses, fortunately, were of logs, the most difficult to overturn that could be constructed. Yet, as it was, whole tracts were plunged into the bed of the river. The grave-yard at New Madrid, with all its sleeping tenants, was precipitated into the bed of the stream. Most of the houses were thrown down : large lakes of twenty miles in extent were made in one hour. Other lakes were drained. The whole country to the mouth of the Ohio in one direction, and to the St. Francis in the other, including a front of 300 miles, was convulsed to such a degree as to create lakes and islands, the number of which is not yet known, to cover a tract of many miles in extent, near the Little Prairie, with water three or four feet deep ; and when the water disappeared, a stratum of sand of the same thickness was left in its place. The trees split in the midst, lashed one with another, and are still visible over great tracts of country, inclining in every direction and in every angle to the earth, and to the horizon.

" The inhabitants described the undulation of the earth as resembling waves, increasing in elevation as they advanced ; and when they had attained a certain fearful height, the earth would burst, and vast volumes of water, and sand, and pit-coal, were discharged as high as the tops of the trees. I have seen a hundred of these chasms, which remained fearfully deep, although in a very tender alluvial soil, and after a lapse of seven years : whole districts were covered with white sand, so as to become uninhabit-

able. The water at first covered the whole country, particularly at the Little Prairie ; and it must, indeed, have been a scene of horror, in these deep forests and in the gloom of the darkest night, and by wading in the water to the middle, to avoid these concussions, which were occurring every few hours, with a noise equally terrible to the beasts and birds as to men. The birds themselves lost all power and disposition to fly, and retreated to the bosoms of men, their fellow-sufferers in this general convulsion.

“One result of these terrific phenomena was very obvious. The people of this village had been noted for their profligacy and impiety. In the midst of these scenes of horror, all—catholics and protestants, praying and profane—became of one religion, and partook of one feeling. Two hundred people, speaking English, French, and Spanish, crowded together, their visages pale, the mothers embracing their children. As soon as the omen that preceded the earthquakes became visible, as soon as the air became a little obscured, as though a sudden mist arose from the east, all in their different languages and forms, but all deeply in earnest, betook themselves to the voice of prayer.

“The people, without exception, were unlettered backwoodsmen, of the class least addicted to reasoning, and yet it is remarkable how ingeniously and conclusively they reasoned from apprehension sharpened by fear. They remarked that the chasms in the earth were in a direction from south-west to north-east, and they were of an extent to swallow up not only men but houses, ‘quick down into the pit.’ And these chasms occurred frequently within intervals of half a mile. They felled the tallest trees at right angles to the chasms, and stationed themselves upon the felled trees. By this invention all were saved, for the chasms occurred more than once under these felled trees. Meantime their cattle and their harvests, both here and at New Madrid, principally perished. The people no longer dared to dwell in houses ; but they passed this winter and the succeeding one in bark booths and camps, like those of the Indians, of so light a texture as not to expose the inhabitants to danger, in case of their being thrown down.”

Our space will not admit of any detailed enumeration of the early theories for illustrating the cause of earthquakes, and it is of but little consequence, as they are of the most vague and visionary kind. Until very lately, they were supposed to arise from the united action of sulphur and coal in the bowels of the earth ; there is, however, but little doubt that the real cause, both of earthquakes and volcanoes, may be traced to the blending of large volumes of water with those metals which form the alkaline and earthy bases. These instantly burst into flame, and we well know that no weight, however mighty, or material, however strong, can resist their combined action. Those who have seen a massive iron case, many inches in thickness, burst by the force of a few drops of water converted into steam, will fully comprehend the elastic force of thousands of gallons acted upon by the most intense combustion of potassium or sodium.

Both earthquakes and volcanoes tend very materially to purify the atmosphere, and they have generally been found to follow long periods of disease, if not absolute pestilence, and when indeed some such revivifier was absolutely needed. What is still more important, they serve as moral landmarks to show

how completely we are in the hands of that Providence whose visitations find us as surely on the firm set earth as when we brave the depths of the ocean.

E A R W I G. The ordinary English name of the *Forficula auricularia* of Linnæus, an insect so common as to require but little description to render the reader acquainted with it. The body is of an elongated form, and is terminated by scaly forceps formed of two long and curved horny appendages, pointed at the tip, and having several small teeth on the inner margin. The wing-covers are short and square, not covering more than one-third of the abdomen ; the wings are of large size, although but seldom seen, being shut up by means of numerous longitudinal and transverse folds, so as to occupy but a very small space. This insect has so much the appearance of some of the *Staphylinidæ* (see BRACHELYTRA), that Linnæus was induced to place it in the order *Coleoptera*, with which it indeed agrees, in having the wing-covers united (when closed) in a straight line ; the transformations, however, which it undergoes do not agree with those of the beetles, the insect retaining its powers of locomotion, and, consequently, of feeding during the pupa state ; in which respect, as well as in the structure of the mouth, it resembles the grasshoppers and other orthopterous insects. From these, however, it differs so much, that Dr. Leach, M. Leon Dufour, and others, have formed it into a distinct order, whilst Latreille and his followers unite it with the orthoptera, but form it into a distinct section. In this respect, therefore, it will be seen that the despised earwig assumes a considerable degree of interest, which will not be lessened when we learn that the generally received opinion that it creeps into the brain of sleeping persons through the ears (an opinion current in most countries, as we learn from the names of *perce-oreille* given to it by the French, *oren-wurm* by the Germans, and *oren-metel* by the Dutch) is one of those popular errors which are so difficult to root out. That the ear-wig may on some occasion or other introduce itself into the ear of a person sleeping on the grass or in outhouses, is not more unlikely than that any other insect which resides in holes and crevices in such situations should do the same ; but the structure of the human ear would completely prevent any insect from entering the head, whilst the situation itself would evidently be as uncomfortable to the insect as it would be to the person annoyed.

The food of the earwig consists of vegetable matters. It does much mischief in gardens, devouring not only fruits, but also the petals of flowers ; indeed they are one of the greatest pests to the florist. We have observed that they are especially destructive to the noble flowers of the dahlia, but we are unable to give any more effectual recipe for their destruction than is contained in the following quaint extract from Old Mouffet :—“The English women hate them exceedingly, because of the flowers of close gilliflowers that they eat and spoyl, and they lay snares for them thus : they set in the utmost void places ox-hoofs, hogs’-hoofs, or old cast things that are hollow, upon a staff fastened into the ground, and these are easily stuffed with cloathes or straw ; and when by night the savages creep into them to avoid the rain or hide themselves, on the morning these old cast things being suddenly taken away and shook forth, a great multitude of them fall and are killed with treading upon them.” The modern Londoners have

supplied the place of these ox-hoofs in their trim-kept gardens with the hollow claws of lobsters, which give their borders a very droll appearance.

As a set-off against the mischievous propensities of these insects may be mentioned, the peculiar and almost unique instance which the females afford of maternal care for their young progeny. In general the care taken and the labours undergone by female insects in the construction of nests, are but the result of instinct, the parent dying long before the birth of her progeny; but in the earwig the reverse of this takes place. Not only do these females take great care of their eggs, covering them over with their bodies, brooding over them like a hen, and collecting them with great care when scattered about, but show great affection to the young when hatched. These young ones differ only from their parents in their small size, want of wings and wing-covers, and the slenderness and straightness of the forceps at the extremity of the body. In the pupa state they are equally active, and have the wings and wing-cases distinct, but enclosed in flat sheaths of a small size applied closely to the back. The attachment existing between the parent and her young is reciprocal; De Geer having discovered a female in the month of June under a stone sitting upon her progeny, which appeared to be just hatched, and which nestled under their parent like chickens under a hen. Having removed this family into a box with earth, he observed that instead of burrowing into the ground as might have been expected, the young ones crowded under the body and between the legs of their parent, who remained quiet and allowed them to continue in this position for hours together. He fed his captives with morsels of ripe apple, upon which they thrived, casting their skin several times like caterpillars. The parent did not live long in confinement, and the young ones had the cannibalism to eat the dead body of their parent. After this the number of the brood diminished, without any remains of the dead bodies being observed: whence it is to be inferred that the survivors had also devoured their dead bodies. This, however, would most probably be occasioned by the want of their proper food, as they never thus prey upon each other in a state of nature. After the final moulting, the wings are expanded to their full size, in which state they are very beautiful objects, not only for their delicate structure, but from the singular direction of the nervures, which are quite unlike those of any other insect.

There are numerous species of earwigs, six or seven of which are inhabitants of this country. Little is, however, known of their habits. See FORFICULA.

EBURNA (Lamarck); — BUCCINUM (Linnæus). Lamarck has separated this genus from the Linnæan Buccinum, of which it formed a part: he was led to do so in consequence of the peculiar characters of the umbilicus and of the columella, which is prolonged at the lower end, and forms a canal occupying the remaining part of the left side. In almost every other respect it possesses the same characters as the buccinum. One species, the *Eburna Zeylandica*, is remarkable for the spines with which the umbilicus is filled, and they are only to be observed in that species. The animal closely resembles that of the buccinum. The writer has seen specimens of the genus *Eburna*, in which the channel on the right side was quite closed and coanealed, in which state it had every character of the buccinum. These shells are found in the Indian

seas principally, a few in the South seas, but no fossil species have yet been discovered.

ECASTAPHYLLUM (Browne). A genus of tropical plants belonging to *Diadelpbia Decandria*, and to the natural order *Leguminosæ*. They are evergreen shrubs, and are easy of culture, and easily raised from cuttings.

ECCREMOCARPUS (Ruiz and Pavon). A genus of South American climbers, belonging to the class *Didynamia*, and to the natural order *Bignoniaceæ*. Generic character: calyx bell-shaped, limb of five spreading divisions; corolla tubular, swollen above, throat contracted, limb consisting of five reflexed lobes; stamens included with the rudiment of a fifth; anthers free, fleshy, divided at the base; style bearing a bilamellated stigma; capsule oval, compressed, papery, one-celled, two-valved; seeds imbricated, with membranaceous wings. These are very suitable climbers for covering the columns in a greenhouse or conservatory, as they are free flowerers, and easily managed and propagated.

ECHASSIERS—stilt-birds. The fifth order into which the feathered tribes are divided, in Baron Cuvier's arrangement. For the propriety of the name, and the relations which they bear to the other orders, we may refer the reader to the article BIRD. They have the lower part of their thighs always naked, and the tarsi are, generally speaking, long. These circumstances enable them to wade into the water without wetting their plumage; and as they in general frequent only the shallows, there are few of them that can swim. Some of them have the bill strong, and these feed upon fishes and aquatic reptiles which they seize in the water. Others have the bill feeble, and they feed upon insects and worms. A few of them also feed upon seeds and other vegetable substances, and they are the species which inhabit farthest from the waters. The greater number have the outer and middle toe united by a membrane at the base, but the inner toe is generally free, and the feet not adapted for swimming. Sometimes, however, the toes are emarginated with membrane; and in many the hind toe is entirely wanting, which in most is so short as not to touch the ground when they walk. With the exception of the ostriches, the cassowaries, the emus, and some others, all the order are well-winged birds, and thus capable of transporting themselves through the air when it becomes necessary for them to shift their pastures with the seasons. The short-winged ones are those which are the least aquatic, but they are very swift of foot, and capable of ranging very freely on the surface of the ground in those parched and semi-desert places on which they are most frequently found. Those which are more aquatic in their habits are generally migratory, either within the same country, or from country to country, to a longer or shorter distance, as circumstances may require.

They are divided by Cuvier into five principal families, and some isolated genera which do not very properly come into any of the larger and more regular divisions. The first family, *Brevipennes* (short wings), includes the ostriches and the allied genera, the *struthiones* of many naturalists, together with the apteryx and some others. The second family, *Pressirostres* (compressed bills), include the bustards, plovers, lapwings, oyster catchers, and several other genera. They are not in general fishing birds, though they inhabit the moist grounds or the margins of the waters. The greater number of them are birds of swift foot,

and spend a great deal of their time on the ground, though most of them are also birds of ready wing when they do take the air. The third family, *Cultrirostres* (knife-shaped bills), are, generally speaking, birds of much larger size than those of the second division, if we except the bustards. They are also more aquatic in their habits, and the flesh of most of them is very inferior for food. They include the cranes, the storks, the herons, the boatbills, and various others. The bills of all this species are fitted for seizing prey of considerable dimensions, which is, however, more frequently fish, reptiles, or garbage, than warm blooded animals in the living state. Some of them have the bill of immense size, an instance of which will be found in the article ADJUTANT. The fourth family, *Longirostres* (long bills), have that organ generally much produced, but varying much in texture and in form, according to the kind of their food, and the mode in which they obtain it. Some of them range along the banks of streams, and pick up refuse, but the greater part feed upon insects, worms, and other small animals, in or near the shallow waters, or the sludgy mud. The fifth family, *Macroactyles* (long toes), includes those species which have the toes proportionally much larger than those of any of the other species. Some of them have the toes without webs, or only with mere rudiments; but others have them partially webbed or margined for their whole length, and can either run along the waters or occasionally swim. The carrying bird of New Holland, the pratincole, and the flamingo, are the principal ones which stand apart, and do not strictly belong to any of the five families.

ECHENEIS (*Remora*, or Sucker-fish). A genus of soft-finned fishes, with the ventral fins immediately under the pectorals. Their most singular character is the sucker with which they are furnished on the upper part of the head, and by means of which they can attach themselves to rocks, to the bodies of other fishes, to the bottoms of ships, to floating wood, or other substances. But though this organ is called a sucker, it is not capable of performing the operation usually called sucking; that is, they do not, by means of it, extract any part of the substance of that to which they fasten themselves, either for the purpose of holding on in currents, or for that of being borne along on that which floats or otherwise moves in the water. Various stories have been told of those fishes arresting the course of vessels in full sail, and doing other things equally marvellous; but we need hardly add that these are wholly destitute of truth. That a ship would not sail the faster for having these fishes on it is true, for in equal numbers they would have nearly the same retarding effect as barnacles or sea-weed, but it would take a great number of them to have any effect.

The sucker consists of a number of transverse cartilaginous laminae, which are directed obliquely forwards at their external extremities, denticulated on their posterior edges, and moveable at pleasure by the fish.

All the genus have the body elongated and covered with small scales. They have a single soft dorsal fin placed immediately over the anal. The head is quite flat on the upper side; the eyes are placed in the sides; the mouth opens horizontally, and is rounded at the muzzle; the lower jaw is the longest, and both are furnished with small teeth placed cardwise, but with a more regular row around

the sides of the jaws; the front edge of the vomer is also covered with small teeth; the gill-flaps contain eight rays; the stomach is a large eul-de-sac; they have eight or nine caecums; their intestinal canals are short and simple, and they are without any air-bladder.

These fishes, in one or other of their species, are found in almost all seas, and their peculiar form early drew the attention of observers, and gave occasion to those fabulous stories to which we have already alluded. That the singular apparatus with which the heads of these fishes are furnished answers some important purpose in their economy cannot for a moment be doubted, because we never find a specific organ in any animal without a specific use to which that organ is applied. The sucker in these fishes is fit only for one purpose, that of adhering, and therefore there can be no doubt that this is precisely the use which they make of it; and as it is equally fitted for adhering to fixed and to moveable substances, it is equally efficient as an instrument of repose and an instrument of motion. Furnished with this simple but beautifully-formed apparatus, they have a perfect command of themselves in all seas without the muscular effort necessary for maintaining their position in spite of currents, and making their way for long distances without exertion of their fins. Adhering to the rock by means of the sucker, they can, as the flood races by loaded with those small animals on which they feed, remain perfectly at rest in the very turmoil of the waters, and feed in safety where no other fish can maintain its position. It will be readily understood, that, as the sucker holds on by a perfect expulsion of the water from the surface to which it attaches itself, it will retain its position by not only the pressure of the air, but by that of all the depth of water over it, and if this happens to be equal to about thirty-three feet, it will adhere with the force of about thirty pounds upon each inch of the sucker. This is quite sufficient to retain a small and slender-bodied fish against any rush of the water which we can imagine to occur in the sea; nor would it be easy to pull any of those fishes from the rock by main force. In consequence of this powerful means of adhesion, it can select the swiftest and most powerful fishes in the sea for its beasts of burden, and ride safely through the water, without effort on its own part, and also without very much impeding the motion of the fish to which it adheres. It attaches itself to most of the fast-swimming fishes which play near the surface; but we believe the shark, in one or other of its species, is the one which it prefers, and it is often seen attached to this powerful fish when racing along the deep with more velocity than the fleetest horse can display upon land. In these its excursions, it no doubt finds abundance of food in those small animals which float near the surface, especially in the warmer seas; and while it can be thus employed, it is itself perfectly secure from danger, because if it once gets hold, the fish to which it is attached can do it no harm, however voracious that fish may naturally be.

There are several species of this fish, and though they are very generally distributed, they are much more abundant in the warm seas than in the cold ones, being most plentiful near the equator, and especially in those intertropical regions, where currents of the water are continually setting. Except for the peculiarity of its structure no fish of this genus is of much interest. They are hardly ever used for food,

as the quantity of flesh on them is but small, and the quality inferior, and in addition we may remark that if a fish has any thing very peculiar about it, that arms the superstition of dislike, such a fish is apt to be loathed, without any very reasonable cause.

E. remora is the species which has been longest known; it is found abundantly in the Mediterranean, and is most celebrated for stopping ships in their course, and doing other great feats. It is a trifling fish, not above five or six inches in length, and of an ash colour. It is found occasionally in other seas.

E. naucrates is a much larger species, often attaining the length of two feet and a half or three feet. Its back and tail are variously marked with greenish tints, and its sides with brown. Its fins are yellowish with brown borders.

E. lunata is about the same size, but it has the dorsal fin very long and sometimes obliterated in the middle, and the caudal fin forked. It is black on the back, and grey on the sides. It is a native of the West Indian seas.

ECHEVERIA (Decandolle). A genus of succulent under-shrubs, natives of Mexico. They are decaandrious, and belong to the natural order *Crassulaceæ*. Some of the species have handsome flowers, and are very hardy greenhouse plants. They succeed in the same kind of dry soil like other succulents; and no plant is easier propagated, for if the upper leaves only are laid on the surface of a pot of earth, they put forth fibres and become perfect plants.

ECHIDNA. A very singular genus of marsupial mammalia, forming, along with *Ornithorhynchus*, a group which Cuvier has placed in the order *Edentata*, or toothless animals; but of which both the structure and the habits are so peculiar that they do not come very well into this, or indeed into any other part of a system founded on the organisation. In the English books the genus under consideration is confounded with *ornithorhynchus*, under the name of *hystrix*, or *hedgehog ornithorhynchus*; but both the structure and the habits forbid this union. The *ornithorhynchus* is a web-footed animal, inhabiting only the waters, and, from the structure of its mandibles, apparently dabbling in the mud, and feeding upon the small animals which that contains, in the same manner as the dabbling ducks, though it is much more a diving animal than any of the duck family, or than any other of the mammalia which find their food in the waters, and have at the same time the four extremities so much produced, and free of their body as to be entitled to the name of legs. The *Echidna*, on the other hand, are not aquatic; and, though they have the mandibles or jaws produced, and formed of a horny substance, without any teeth except small ones on the palate, they do not frequent the waters, neither are their *bills*, as they may without any impropriety be called, at all adapted for dabbling in the mud. Their tongues are extensible to a considerable distance beyond the extremity of the mandibles; and, therefore, the natural conclusion is, that they are insectivorous. Very little is known of their habits, however, for they do not appear to be very numerous, and they burrow so rapidly in the ground, that even when one is discovered, it is not very easily got hold of. The back, and upper part generally, is so thickly beset with spines, and those spines are so sharp, that, though the animal is not larger than the common hedgehog, it cannot be lifted with impunity; and, indeed, the lifting of it requires more force than would be expected from its size, as it

is firmly fixed to the ground in an instant, and but a few moments elapse, before it is so far down that its back is level with the surface. For a long time these animals, the few that were obtained, were procured in their native country, Australia, either from the natives, or by other collectors of curiosities equally ignorant, or, at all events, equally inattentive to any other consideration than that of obtaining the curious animal and getting a price for it; so that nothing was known of the habits, or of that change of structure to which it has since been found that the female is subject in the course of propagation. The researches of more scientific and observant inquirers have, in later times, removed the greater part of the difficulty; and it is now ascertained that the animals of this, as well as those of the aquatic genus, are true mammalia, suckling their young, though the mammary system is more peculiar in them than in any other of the marsupialia, singular as some of these are.

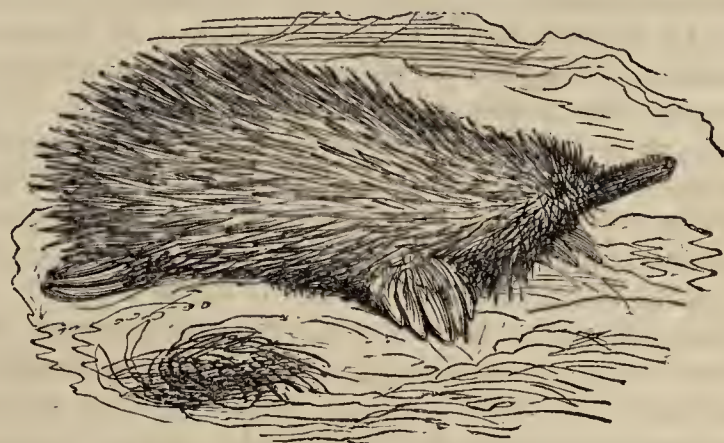
In consequence of there not being any appearance of mammary glands on the female, and no account having arrived as to the fact of those glands being developed only when the state of the animal requires them, and absorbed when no longer necessary, it became impossible for even the most skilful and judicious comparative anatomists to determine, from dissection of the few specimens which they obtained, whether the animals were mammalia or oviparous; and as such forming part of a mongrel, or at all events peculiar race, to which nothing analogous was known, in any other part of the world, or in any other department of zoology. The female being wholly without teats, there being only one common *cloaca*, or vent, as in birds, and some parts of the skeleton having an approximation to the bird structure, it was perhaps not unnatural to conclude that the animals were reproduced by eggs. This was farther rendered, if not more probable, at least more tempting to the belief by announcements that the eggs of the *ornithorhynchus* had been found on the banks of some of the Australian rivers. It was natural, when the mode of reproduction in these animals had become a subject of great interest to naturalists all over Europe, and when, in consequence, there was a great and profitable demand for the animals themselves—it was natural that there should be a strong desire on the part of collectors to find the eggs, because the finding of these would have covered the finder with the glory of having been the means of establishing the most anomalous fact in the whole physiology of the animal kingdom. Accordingly an *ornithorhynchus* was seen escaping into the water, from a little bank in an Australian river, and presently the eggs of a lizard were found close by, and thus there was at least the evidence of juxtaposition that these were the veritable eggs of the *ornithorhynchus*. The finder probably could not, and the naturalists to whom the eggs were submitted in Europe at all events did not, institute any inquiry as to what kind of integuments these eggs really had, and what kind the anomalous animals should have, in accordance with the other parts of their singular physiology. Latterly, indeed, some of the British naturalists threw out a hint that the eggs in question were very like the eggs of lizards, or of reptiles of some kind; but it does not appear that they examined them with so much attention as to enable them to decide the truth of the hint. This is rather a matter of importance; because it shows the necessity of attending to the structure of an animal in all its stages, the egg among the rest, if

it happens to pass through that stage, in order that the learned may escape the charge of playing the cuckoo, by laying the egg in the wrong nest.

Before the discovery of the egg, Francis Bauer, perhaps the finest microscopic dissector and painter of the age, at least since the death of his brother Ferdinand, had given it as his opinion that these animals must be mammalia and not birds. He arrived at this conclusion by a careful examination of the ovaries of the female, which he found, both in their own structure and in that of the rudimental ova which they contained, were of the mammalia character, and by no means that of a bird. This was going to the fountain head, and going there most philosophically; but the discovery, though perfectly sound and philosophical, because in strict accordance with the whole system of nature, was too fine for the eyes even of philosophers, and as Bauer himself had been all along more remarkable for promoting science than seeking either honour or reward for the promoting of it, this, which was in truth the *experimentum crucis*, was not decisive of the question; and popularly in Britain, and even among the scientific men of France, the fact of juxtaposition, on which alone the story of the eggs rested, triumphed over the philosophical demonstration of the ovaries; and up to within a comparatively short period, namely, till the year 1833, a dispute was carried on between the zoologists of France and of England, in which the former contended that the oviparous theory was the true one.

On the part of the British zoologists this controversy was conducted with great ability by Mr. Owen, from whose communication to the committee of science of the Zoological Society, made on the 23rd of October, 1832, we shall by and by make an extract. The dispute was not so much as to whether the animals are or are not produced from eggs or germs of some sort or other, but whether the young are suckled by the mother. In all the marsupial animals, in which the characteristic organs of the female are any thing like perfect, the embryo, when it leaves the internal uterus and is transferred to the abdominal pouch, is not a fully developed animal, but a mere rudiment, though a rudiment bearing no resemblance whatever to the egg of any oviparous animal; and this, together with the character of the ovaries as above noticed, would lead to the conclusion that in echidna there is no departure from the general economy of the division of animals to which it in this respect belongs. The real point at issue was whether these animals do or do not suckle their young, and upon this point the observations of Mr. Owen are quite conclusive, and not only so, but the young have since been found in the suckling state, and with the horny mandibles so perfectly undeveloped, that the mouth, though not of exactly the structure for drawing milk from the nipple, was yet well formed for pressing that substance from pores or small openings in the gland containing it. Mr. Owen admits that though the fact of the suckling is established it would not prove the converse, namely, that the young which was suckled had been brought forth alive; but it goes far, and we think sufficiently far, for proving that the animal comes as properly within the ordinary habits of production among marsupial animals as the kangaroo or any other of the class. Mr. Owen mentions the fact of the length of time that many birds are wholly dependent on their parents for their food, and also that the pigeon and some others supply this food in part from a peculiar

secretion of their own bodies; but the secretion in this case is from the stomach, and it is in part mixed with the partially assimilated food of the old bird, whereas a mammary secretion is formed by a peculiar apparatus, an apparatus which is more peculiar, and has a more complicated operation to perform in marsupial animals than in those which deliver their young from the internal uterus in a perfectly matured state. Thus it appears to us that the fact of the agreement of those singular animals with the rest of the marsupiala, in this, the most important function of their lives, has been completely established. The point is one of the most singular which was ever raised in natural history; and had the proof gone the other way, it would have thrown the whole physiology of the vertebrated animals into a state of uncertainty, by which the progress of real science would have been greatly retarded. Those who take an interest in nature, who love to have the beautiful plan and purpose that runs through the whole, and the perfect agreement of structure and function in every part, not only as making system the instrument of discovering truth, but as leading to those reverential feelings for the Author of Nature, which are so conducive to the intellectual and moral elevation and happiness of man, cannot fail in being grateful to Mr. Owen as his coadjutor, both in Britain and Australia. We shall close our general remarks by our promised quotation from Mr. Owen:—"It affords me much pleasure," says Mr. Owen, "to be able to lay before the committee preparations of the mammary glands from the *Echidna hystrix*, which, as the following description will show, afford an additional instance of the close affinity subsisting between it and ornithorhynchus, notwithstanding the great dissimilarity existing between them in external form and in the nature of their integuments. These glands were discovered in a female specimen not quite arrived at maturity, and which, therefore, in all probability had never been impregnated. They are consequently very small, as compared with those which have been observed in ornithorhynchus, but are precisely analogous in number, form, composition, situation, and mode of termination on the outer surface of the integument.



Echidna.

"The terminal ducts, which are fewer in number than in ornithorhynchus, are similarly grouped together, so as to form a small oval *areola*, three lines in the greater and two in the lesser diameter. Each *areola* is situated half an inch from the mesial line, and three and a half inches from the orifice of the vestibule of the *cloaca*. They are much more readily discovered than in ornithorhynchus, in consequence of the hairs in the *Echidna* being scantier and stiffer, so that the

orifice for their transmission are larger than the orifices of their ducts, which is the reverse of what is observed in *ornithorhynchus*: this, however, may not be the case in the fully developed gland. The *areolæ* are also slightly raised above the surrounding integument, but there is no vascular *rete* or erectile tissue discoverable at these parts. The lactiferous ducts, before penetrating the *corium*, pass between the fibres of a dense *panniculus carnosus* which is here, as in *ornithorhynchus*, interposed between the glands and the integument. The number of the ducts is about sixty. The lobules of the gland are proportionally shorter and broader. Their texture under the lens appears the same as *ornithorhynchus*, that is to say, minutely cellular, and in neither instance consisting of simple *cæca* or elongated follicles. From their small size in the *Echidna* they could not be injected.

"The smallest size which these glands have presented in *Ornithorhynchus* is about one-third larger than those in *Echidna*, now exhibited; in this state, the ovary and uterine tubes were small, and apparently in a state of quiescence. When the ovary is fully developed, and the uterine tubes correspondently enlarged, the mammary glands are about two inches in the long, and one in the short diameter. When the ovary is found large, but flaccid, and apparently after having shed its contents, and when the uterine tubes are still large, then the mammary glands exhibit their greatest development, equalling five inches in the long, and three inches in the short diameter, and being nearly half an inch in thickness. In this state, they may be readily injected; when the lactiferous ducts, to the number of about one hundred and fifty, are seen to terminate in a small oval *areola* on the external surface, not on any raised eminence, but on the level integument, from which the bases grow as freely as in the surrounding parts. Nevertheless, from the glands being confined to the female, and exhibiting, by their variation of size, that their function is temporary; and as the period of their greatest enlargement is shown, by the state of the uterine organs, to be subsequent to the development and expulsion of the *fœtus*; they must be regarded as being true mammary glands destined to provide nourishment for the newly-born animal. The peculiar development of the *panniculus carnosus* over the ventral region, both in *Echidna* and *Ornithorhynchus*, will assist in explaining the mode in which the lacteal secretion is conveyed from the parent to the offspring. The gland lying between this muscle and the expanded cartilages of the ribs and the marsupial bones, is subject to compression, and the young animal need only apply its soft and flexible lips to the *areola* in order to receive the secretion."

The characters are, the muzzle or bill very slender, terminated by a small mouth, with the tongue extensible, like those of those of the ant-eaters and pangolins; and the probability is that, like those creatures, they feed chiefly upon ants and other small ground animals, which are exceedingly numerous in Australia. They are without teeth in the jaws, which instead are terminated by the horny mandibles already mentioned; but in the palate they have numerous rows of little spines. Their feet are very short, and each furnished with five claws, very long, strong, and well adapted for digging. The whole upper part of the body is covered with spines, bearing some resemblance to those of the hedgehog; and when they are apprehensive of danger, and unable to escape from it

by burrowing, they can erect their spines, and roll themselves in a ball like the hedgehogs. Those spines are not their entire covering, but are mixed with hairs, and on the lower part of the body there are hairs of a spinous form, which are tubular and tapering to the points. Their shoulders are so formed as that the foot can work something after the fashion of the wings of birds; and the articulations of the shoulders are kept apart anteriorly by a sort of furcal bone. In this respect their shoulders have a resemblance both to the lizard tribe, and to the smaller mammalia which burrow in the ground. There are two species, of which the habits so far as known do not differ, the chief difference being in the covering.

SPINOUS ECHIDNA (*E. hystrix*). All covered over with strong spines on the upper part, varying from an inch and a half in length, white for the greater part of their length, but the points black. Those on the tail are erected, but those on the upper part of the body are sloping, unless when the animal is excited. Among the bases of the spines, there is a quantity of coarse short hair of a reddish colour. The head and under part of the body are also covered with short coarse hairs. This species is about the same size as the common hedgehog; it has been found only in New Holland.

BRISTLY ECHIDNA (*E. setosa*). This species is a little larger than the former, has the claws shorter, but more hooked and pointed. The whole body is covered with produced bristly hair of a maroon colour, which conceals the spines, and this thick covering reaches as far forward as the eyes. The muzzle is black and naked, all the under part is covered with stiff white hairs, bearing some resemblance to hogs' bristles. This species has been found in Van Diemen's Land, and also in the islands which are situated in Bass's Strait, between that island and New Holland.

ECHIMYS—spinous rats. A genus of rodent mammalia, bearing a very considerable resemblance to the common rats in their size, their general form, and several other particulars, but differing entirely from them in the nature of their covering, their haunts, and their geographical distribution.

All the species of this genus, which are pretty numerous, and of which we shall give a short account, are natives of the central and northern parts of America. They are inhabitants of the woods, nestling in the herbage, at the roots of trees, and not coming about houses, or on the cultivated grounds. Their food is understood to consist chiefly of fallen plants and other vegetable matters.

They resemble the rat, properly so called, in the oblong form of their heads. They have four grinders in each side of both jaws, but they are differently formed; those in the upper have ridges of enamel, arranged in the form of the letter V, while in the under jaw they have one simple lamina, and a plaited one. In the upper jaw all these four teeth are nearly of equal size, but in the under jaw the front one is nearly equal to all the other three. The distinguishing characters of the skull are, that the suborbital bone is very much enlarged, that there is no temporal fossa, and that the ridge of the frontal bone is very much produced on each side, so as to afford an ample enfoncement to the eye. The body is elongated like that of the true rats. The tail varies in length in the different species, but it is always round in its section, and often covered with scales, and in one species only it is covered with very fine hair. On the forefeet in

all there are four toes, with a rudiment of a thumb ; but there are five toes on the hind feet, and all the toes are armed with very strong crooked claws. Besides the fallen fruits which they find under the trees, they are understood to feed, in the dry season especially, upon bulbous and tuberous roots, of which there is an immense number in the countries which they inhabit. South America is the grand country for tuberous roots, especially those of the *Amaryllideæ*, of which so many have been introduced with such beneficial effect into the gardens of Europe. The stems of all these plants die down during the dry season, and the plants are in a complete state of inaction, or ripen at the same time that there is no herbaceous vegetables, or even shrub upon the dry plains, upon which a vegetable feeding animal can subsist. But during this period of the absence of all vegetable food from the surface, the bulbs treasure up a store of the most nourishing and wholesome food, even for human beings ; and the consequence is, that when the breadth of the country appears to be in a state of utter desolation and want, the small rodent animals, which exist in the country in numbers, have a most abundant supply. If the time shall ever come, when we shall be able to see the proper coincidence between the vegetation and the animal life of this part of the world, it will be found to be one of the most interesting volumes in the book of nature ; and even now, imperfect and disjointed as our information must be admitted to be, there is no part of the world in which the student of nature is more highly gratified and rewarded than in South America.

And when we duly consider this highly interesting part of the world in all the departments of its natural history, and in all their bearings and relations to each other, we cannot fail to be deeply impressed with the idea of a systematic and harmonious plan running through the whole works of nature, and proclaiming in language not to be neglected or mistaken, that things have all been formed for working in concert with each other, in furtherance of one grand plan and purpose. We have here the most stupendous mountains and the most ample valleys, watered by rivers which have no rivals upon the face of the earth. We have the most powerful volcanic action, and upon the more lofty summits of the mountains, we have, perhaps, the most terrible action of the atmosphere to be found over the whole surface of our globe. Thus, those mountains on that side of the country where they are given up to the intensity of volcanic action and the utmost fury of the storms, are rich beyond all knowledge in other parts of the world, in the most valuable metallic stores ; while, in the regions which are more tranquil in their heights, the accumulation of the most precious gems is without a parallel in any other land. Then, the timber of the trees, the medicinal gums, balsams, barks, and other substances, the dyeing woods, the insect dyes, the fruits, the esculent roots, and, in short, all that can grow out of the earth, where shall we find a parallel to what is met with, furnished by all prolific nature, without labour and without price, in South America ? Nor can we overlook the navigable rivers, which may be ascended in barks of large burden, to the distance of not less than two thousand miles, while the navigable branches tempt commercial enterprise to nearly the same measure in the cross direction. All this is so temptingly wonderful, whether we seek

for information or for profit, that no thinking mind can pass it over with indifference. Nor are the animals less wonderful. It is true that we have not in a state of nature the grazing animals of any other part of the world—the bisons, of which a remnant still lingers in a few spots of Europe, the antelopes of Southern Asia or of Africa, or even any animal that can be compared to the large kangaroo of Australia, to say nothing of the vast herds of roving animals that were once found upon the central savannahs of North America. But what of all this ? We find originally in the luxurious forests which have no rivals in grandeur or in the life which they support, the sloths playing the part of grazing animals against the sky, a sort of vegetable feeders that spend all their time with their backs to the ground, as if the very air in South America were able to yield that nourishment to animal life which requires the whole strength of the solid earth in our less propitious portion of the globe. Nor must we forget that while in every other part of the world those animals which are most valuable to man in a state of domestication, the horse and the ox for instance, have, as in wild nature, always faded away in proportion as the human race has multiplied, the case of these very animals in South America has been quite the reverse. The extent to which both wild cattle and wild horses have multiplied, in the more southerly and champaign parts of the country, and that too while the population has been rapidly on the increase, is really something new and eminently striking in the study of our earth. It is impossible to turn one's attention, even in the most casual and cursory manner, to this part of the world without being impressed with the conviction that there is in it every thing that can stimulate the very highest powers of man, and reward his most powerful exertions. But it is a field only for the great of mankind, for those who can understand and appreciate its greatness ; and it is doubtful whether it has yet been owned by a people who are worthy of it. Enticing as it is, however, we must withdraw our attention from the general consideration of it, in order to notice the species of that genus of its indigenous mammalia, by which these few desultory remarks have been suggested.

E. cristata—the crested spinous rat. This species is the golden-tailed rat of Buffon. In its size and the form of its tail, it bears no inconsiderable resemblance to the common rat ; but it differs much in the colour of its covering and the form of its ears. Its colour is maroon with a purple ground, very deep on the back, the sides, and sides of the head, but higher on the under part. This colour extends along the tail for a short distance from its base ; but the principal part of that organ is of a rich orange, and there is a spot of the same colour on the face. There is a portion of the tail between the maroon and the orange of a black colour, and the hair upon the whole of the tail is short and fine. The head is large in proportion to the size of the animal ; the muzzle and facial line are straight ; the eyes are very small ; and though the ears have large openings, they do not rise much, if at all, above the level of the head. At the corners of the upper jaw, there are tufts of brown hair forming a sort of whiskers, which are longer than the breadth of the head. The hair on the back of the animal is coarse and strong, flattened in the section, and more than an inch in length, and bears some resemblance to shining pins. It continues on the sides and flanks, but is wanting on the lower part of the body, which is covered with

softer and smoother hair. On this part of the body it is very short, not exceeding one twenty-fourth part of an inch in length, and the individual hairs are round in their section, instead of being flattened like the longer hairs on the upper part. The female has eight mammæ, which indicates a progeny rather numerous, though comparatively nothing is known of the manners of the species. It is understood, however, that they are subject to considerable variety of colour, either in different individuals or at different ages; for some have been brought to Europe in which the produced and flattened hairs on the upper part were brown and not maroon; but as these were smaller in size than the more richly coloured ones, it is probable that they were in an immature state. This species lives in the woods under trees, and is supposed to subsist chiefly upon fruits.

Echimys dactylinus. This is one of the largest species of the genus, being more than ten inches from the muzzle to the insertion of the tail, and the tail itself is very long, not less than fourteen and a half. The hair upon the body is hard and dry, but not spinous; that on the front is flattened; but on the hinder part it is longer and rougher; and on the upper part of the neck it stands up like a sort of crest. The middle toes of the feet are much larger than the outer ones; the nails on the toes of the fore feet are flat, something in the form of those of the sapajous; but on the hind feet, which have five toes, they are very strong and crooked; the tail, throughout the whole of its length, is naked of hair, and scaly. The manners of this species are very little known.

Echimys spinosus. This is the spiny rat of D'Azzara. It is much stouter in the make than the common rat. It stands three inches three quarters high at the shoulder, and four inches at the crupper. The length, from the muzzle to the tail, is ten inches, but the tail is not more than three, if as much. The tail is wholly covered with smooth hair, which completely hides the scales with which the skin among the roots is covered. The eyes are larger than in most of the other species, being not less than a quarter of an inch in diameter. They stand out very prominently, and are about equally distant between the point of the muzzle and the ears. The nose is truncated vertically; the mustachios project only about a quarter of an inch, and the ears do not rise more than a third of an inch from the back of the head. The length of the frontal base is about three quarters of an inch; the ears are naked, and very flexible; the exterior toe on the hind feet is the largest of the whole, but the claw on it is a sort of nail, and does not extend to the same length as those on the other toes, the claws on the intermediate ones being very strong and crooked, and more than a quarter of an inch in length. The body is covered with two sorts of hair, one soft and fine, and of a white colour, the other consisting of two spines about three quarters of an inch in length. These spines are reddish or brown for about one-third from the point, and whitish for the remainder to the roots. They are very much mixed and matted with the softer hair, and there is a tuft or bunch of them before the opening of each ear. The spines of this animal come off in handfuls as easily as the hair of the agoutis. It is a burrowing animal, and forms its hole in a bank where it may be above the reach of the inundations, which are common in the rainy

season in Upper Paraguay, and those other parts of South America in which it is found.

Echimys hispidus. This species is about four inches in height and seven in length, including the tail. It is of a reddish brown colour, which is deepest in tint on the back, upon which also they are largest, strongest, and most abundant. Its tail is without hair, scaly, and annulated. This species has been brought to Europe from South America, but the particular locality is not known, and consequently we are wholly ignorant of its habits.

Echimys delphaidis is about ten inches in length five in the body, and the same in the tail. The tail is covered with hair to within about an inch of the tip, and that portion has verticillate scales, resembling those on the tail of the common rat. It has spinous hair on the back, of a bright brown colour, darker on the sides, and yellowish on the belly.

Echimys Cayanensis. As its name implies, this species is from Cayenne. The body is six inches long; it is bright reddish brown on the back and sides, and pure white on the under part. The hairs on the back are flattened; they are grey at the roots, brown for some part of their length, and reddish at the points. In this species the tarsi of the hind feet are much longer than in any of the former species, which indicates that it is more of a leaping animal.

Echimys setosus resembles the former in its structure, and is of about the same size, but it is redder in the colour, and the hair on the upper part more resembles bristles. It is from South America.

ECHINACEA (Moench). A genus separated from *Coreopsis* and *Rudbeckia*, belonging to the natural order *Compositæ*. This genus has large high coloured flowers, and is well worth a place in flower borders; they are increased by seed or division of the roots.

ECHINOCACTUS (Link and Otto). A large genus of succulent under-shrubs, chiefly South American. Linnæan class and order *Icosandria Monogynia*, and natural order *Cactææ*. This section of the cactææ are all treated like the others; that is, potted in coarse light soil, mixed with lime rubbish, in well drained pots; allowing but little water, and a dry warm part of the house in winter; but in the summer many of them are the better for being exposed to the summer sun and air.

ECHINODERMATA. The first class into which Cuvier divides his grand division of *Zoophytes*, or radiated animals; and a very singular and far from an uninteresting division of animated nature they form. They are destitute of anything which can be called a regular skeleton, and they are without those specific organs which characterise not only the vertebrated animals, but most of the divisions of the invertebrata; but still not even what we are accustomed to call the most perfect of the first of these, or the most wonderful in the minuteness of their bodies, and the beautiful perfection of their parts in the second, are superior, in the wonderful power of nature's mechanism, to the zoophytes generally, and to the echinodermata in a particular manner. The term echinodermata means that the skin, or investing integument of the animals, is covered with processes more or less elongated, and more or less ridged or truly spinous, according to the different natures of the animals.

The echinodermata are exceedingly complicated in

their structure; they are invested with a well-organised skin, often armed with points, or with spines which are articulated and moveable, and they have an internal cavity which contains distinct viscera. They have also a sort of vascular system, which extends to all parts of the body, and maintains a communication between these and the intestinal canal, and also the organs of respiration, which are often exceedingly distinct. There are also filaments ramified through the system, which appear to answer the purposes of nerves, though these are not always so regular as the corresponding parts of the system in some other divisions of the invertebrated animals. Cuvier divides them into two orders: those which have feet, or at all events organs which answer nearly the same purpose, and those which have no feet.

The echinodermata with feet are, of course, distinguished from the others by their organs of motion. Their skin or covering is pierced with a great number of small holes arranged in regular series, through which there pass cylindrical tentacula of a membranous substance, terminated by small discs, which are understood to perform the office of aëration. The portions of the tentacula which are in the interior of the body are vesicular, and a liquor which is contained in their cavities is sent at the pleasure of the animal to the external cylindrical part, by which means that part is erected, and each of the projections answers the purpose of a little foot, by means of which the animals perform their progressive movements.

The echinodermata have numerous organs. They have muscles which are very distinct, and serve to execute movements which are often complicated as well as rapid. They are understood to be of two sexes, though these are often united in the same animal, and they are exceedingly prolific.

The order under consideration consists of a good many genera, of which the principal are asterias, or sea star, which are common on many of the rocks on the British shores; encrinus; echinus, sea hedge-hogs, or sea eggs, which are often gathered upon our shores, and are covered with a shell beset with spines; and holothuria which have an oblong body covered with a leathery crust, and are open at both ends—these abound in many seas, are plentiful in the Mediterranean, and the Malays collect vast numbers of them in the eastern seas, the Chinese being very partial to them as an ingredient in soups. The whole of this division or order are inhabitants of the sea; and though their distribution is pretty general, they are most plentiful in the warm latitudes, and are never found at any great depth. In the tropical seas, where the water is very transparent, where the perpendicular rays of the sun carry their powerful influence to the bottom, and where, in consequence, the production of life is very great, these animals present a very splendid appearance, from the peculiarity of their forms, and often from the richness of their colours. They are shown as sea cucumbers, and a variety of other names, according to the fancy of those persons whose notice they attract, and who are not acquainted with the names given to them by naturalists.

The second order, or the *Echinodermata* without feet, are by no means so numerous as the first; and they all bear some resemblance in their general form to the genus *Holothuria*. They, however, want the

small vesicular feet with which the species of that genus are furnished, and are covered with a leathery skin without any appendages. The genus *Molpadia* also, like *Holothuria*, have a thick cylindrical body, open at both ends, and they have the mouth surrounded by osseous pieces; *Minyas*, which have the body in form of a spheroid depressed at the poles, which are the two openings, and formed into segments along the sides, something after the manner of a melon; *Pirapules*, which have a cylindrical body enlarged at the head, and a fasciculus of filaments at the opposite extremity; *Tethodermes*, which have the body oval, compressed in front, and with a surface incrustated with little grains which are often very hard; *Siphunculus* have the body cylindrical, and they bury themselves in the sand of the sea—in some countries these are much sought after as articles of food; *Bonellia* have the body oval, capable of being much elongated and forked at its extremity, they live very deep in the sand; and *Thalassema*, which have an oblong oval body but not forked like the former, they also live in the sand. The genera of this last order, which bury themselves in the sand, are generally known by the name of worms.

The whole of the division are singular animals; and it is impossible to imagine anything finer than their internal organisation, or more complicated than the number of their parts. They are all without heads, or feet properly so called, or any organs to which we could impute sensation in our ordinary judgment of animals; but notwithstanding this, they are so numerous that it is impossible not to suppose that the functions which they perform in the grand system of nature's operations, are of no ordinary importance. Those which are not covered with a sort of shell or crust, have very much the appearance of living pieces of jelly, or at all events of very soft fleshy matter. Many of these are of a pleasant taste and highly nutritious quality; but there are others which are not only poisonous when eaten, but which are understood to impart poisonous qualities to those fish which feed upon them. The most interesting ones met with upon our shores are the sea hedge-hogs and the star-fish. The former are most frequently found only as empty crusts, with all the projecting tentacula broken off. They are in general shaped something like an apple, with a small aperture on the top which has been the mouth, and its still smaller one at the opposite extremity. The more minute apertures to which the spines have been attached, are arranged in regular rows, reaching nearly from the one opening to the other, something in the same manner as the meridians do on a globe. They are most abundant on the west coasts, and after the Atlantic has been agitated by storms. The sea-stars or star-fish, are found on most parts of the rocky shores at low water, adhering to the rocks by means of filaments; and they are easily known by their star-like shape.

ECHINOMYIA (Dumeril). A genus of dipterous insects belonging to the great family *Muscidae*, or true flies, having the nose not prominent, the cheeks not produced into horns, the bristle at the extremity of the antennæ simple; the second joint of these organs is longer than the others, and the third is broader, compressed, and somewhat triangle-shaped. The type of the genus is the *Musca grossa*, Linnæus, one of the largest British dipterous insects, being about the size and having much the appearance of

one of the humble bees. The head of this insect is yellow, and the base of the wings reddish. It makes a loud buzzing noise when on the wing. It settles on flowers in woods. The larva, according to Reaumur, resides in cow-dung; the body is yellow, shining, and conical, with a small claw and two fleshy horns at the head. In the chrysalis case (formed of the indurated skin of the larva), which is also of a conical form, the extremity of the body exhibits two distinct spiracles.

We are inclined to believe that this account which Latreille, indeed, adopted, is founded in error, the fly in question belonging to a group of the family which, so far as has hitherto been satisfactorily observed, is entirely composed of species parasitic upon other insects, in a similar manner to the ichneumons.

The fly is rather uncommon; we have, however, met with it in the winged state at Coombe Wood.

ECHINOPHORA (Linnæus). A genus of hardy herbaceous perennials, one of them a native of England, and known by the name of sea parsnep. They belong to the natural order *Umbelliferae*.

ECHINOPS (Linnæus). A genus belonging to the natural order *Compositæ*, commonly called the globe-thistle. They are raised from seeds, and are suitable for filling up vacant places in the shrubberies of the flower garden.

ECHITES (Linnæus). A genus of tropical climbing plants, some of which live in our greenhouses, but the most ornamental are stove plants. Class and order *Pentandria Monogynia*, natural order *Apocynææ*. Generic character: calyx five parted; corolla funnel shaped; stamens included or exerted; anthers connected in a circle round the stigma; five scales round the germen; style simple; stigma thick and with the anthers form a cone. The echites are valued for their flowers; they grow well in loam and moor earth, and are propagated by cuttings.

ECHIUM (Linnæus). An extensive genus of shrubs and herbs, the former chiefly African, the latter European. Class *Pentandria*, order *Monogynia*, natural order *Boraginææ*. Generic character: calyx five parted; corolla, bell shaped; limb of several unequal segments; stamens of different lengths; nut angular. This genus is of easy culture, and propagated by cuttings, layers, or seeds when they are produced.

EDENTATA—Toothless. The sixth order into which the mammalia are arranged by Baron Cuvier. The name is, perhaps, about the best that could be adopted in the present state of zoological science; but still it is a name, the foundation of which is a negative, and therefore it is not one which can convey much information. Further than this, it is not quite accurate, as the greater part of the animals included in it are not entirely destitute of teeth even in the jaws, and of those which are the most destitute in those parts, the greater number are supplied with appendages which answer the purpose of teeth, and not a few with teeth on the palate.

Still the animals which are comprehended in this order are of difficult arrangement in any other way; and they have so few characters in common to all the families and genera, that perhaps the best course to be adopted was that in which the name of the order is not tied down to any particular character of any one of its divisions; but rather made the explanation, or expression, of the circumstance in which they all, taken generally, differ the most from the other animals

which have the feet divided into distinct toes, and in which all the animals of this division, how much soever they may differ from each other, yet perfectly agree. Some, indeed, have a greater and some a smaller number of toes; but in all of them the toes, whatever may be their number, are distinct; and they are, in general, armed with claws, which are powerful in proportion to the size of the animals.

Cuvier describes them as being, in his system of arrangement, the last order of the animals—that is the mammalia with toes, and having no teeth in the anterior part of the mouth. He also admits that the only character, of a positive kind, which will apply to them all, is that of having very large claws, not articulated to the toes in the same manner as in the predatory animals, but a sort of shoes with which the toes are specially and separately furnished, and by which their extremities are protected.

Viewing them with reference to their structure and habits, the animals of this order may be said to form a supplemental class of mammalia, less adapted to the present condition of the earth than to some different one which we may suppose to have existed formerly. Among the monumental animals which are found in the earth, there are some which combine in the same specimen organs which, in the living races, belong only to animals of different classes. We find, for instance, that there have been creatures with wings of more than “eagle-spread,” and with claws appended to those wings, more formidable than those of the most powerful carnivorous animals of the present time, while the armature of the jaws appears to have been sufficient for all predatory purposes on the part of the owners. We are therefore led to suppose that these hooked claws to the wings may have been organs of suspension, by means of which the animals fixed themselves for rest upon the tall plants by which their remains are accompanied, and which appear to have grown where the surface of the earth was covered with water. None of the existing edentata are furnished with any organs of flight; and their motions upon the earth are, in general, but slow; still many of them have, in the structure of the skeleton, traces of the bird character. Some of them have the same articulation of the shoulder, others an approximation to the same structure of the pelvis, and there are others still which have only a single passage for all excretory purposes.

None of them can strictly be said to be the inhabitants of the surface of the earth; they are either climbers or burrowers; or in the case of at least one species, they are aquatic. The greater number feed upon insects and other small earth animals, which require no biting and little or no mastication. They have in general the tongue extensile, so that it is the instrument used in the capture of their food. The few that are vegetable feeders are, in their habits, the very reverse of those ordinary mammalia which feed on the same substances; they browse the foliage of trees, and not the herbage of the ground.

In their whole aspect they are peculiar; and their covering, though varied in the different genera, has yet a common character. Their hair partakes of the nature of whalebone, and many of them are covered with scales or crusts. In their reproductive system they fall into both the grand divisions of placental and marsupial animals; some bring their young to maturity internally, and others advance them only so far in that way. They, in fact, present so many differ-

ences and anomalies in a comparatively limited number of genera and families, that they perhaps throw more difficulties in the way of a clear understanding of the system of nature, than any other of the vertebrated animals.

They are divided by Cuvier into three tribes; *Tardigrada*, or "slow walkers;" *Edentata*, or toothless animals, properly so called; and *Monotremata*, or those which have but one cloaca, or vent, as in birds.

The first family consists of but one single living group, the sloths, of which some account will be found in the article *AI*; they have only the fore teeth wanting; for they are provided with cylindrical molars and with pointed canine teeth of greater length; they are furnished with numerous claws to the toes, by means of which they suspend themselves to the branches of trees, and walk or repose with the back downwards.

Connected with this single existing genus, though differing from it by being much larger in size, and also in some other important particulars, there are two extinct genera, both natives of the same parts of the world in which the existing genus is found, that is in South America. These are the *Megatherium*, which from the skeleton must have been an animal of large size, and the *Megalonyx*, which, though larger than any of the existing species, must have been less than the former.

These are both fossil animals, and, of course, only their skeletons are known to us; but these have been found in a state of sufficient perfection for enabling, at least, some judgment to be formed of what the animals must have been when alive. They appear to have held a sort of middle station between the sloths and the ant-eaters, agreeing with the former in many parts of the skeleton, but being without the produced and pointed canine teeth. Of the state of the country where such formidable animals of this kind were necessary (and if they had not been necessary as part of the general system they would not have existed), we cannot possibly form any idea, but they carry us back to a state of things very different from the present; and from the description of countries which we find the sloths and the ant-eaters now inhabiting, we can at least form some rude guess at that which was more general when the larger animals of similar structure were required for the proper working of the system. The sloths are found only in those parts of South America where the ground is covered with thick forests, and subject to seasonal inundations; and the ant-eaters are found only in places where there is an exuberance of ligneous vegetation, of the substance of which small insects of various kinds, but all in general known by the name of ants, are the natural destroyers. We are, therefore, to infer that, in the early times, when more powerful animals of similar structure, and therefore, as we may suppose, of similar habits, were necessary, there must have been upon the earth a more general and rapid production of ligneous vegetation, which required a still greater abundance of the wood-destroying insects than we find in the tropical forests at the present time, and the greater abundance of this must have rendered a greater number of those animals which prey upon them necessary for the proper working of the system and the due preservation of all the races.

From the form of our globe, the place which it holds in the system, the motions which it performs,

and the consequent mode of the distribution upon it of that influence of the sun which is the grand stimulus of all kinds of life, every species of production and action upon it, wherever it may have taken place, must have been seasonal—must have had its spring, its maturity, its fall, and its repose.

Without any reference to the Great First Cause by which the universe is regulated, our earth is under the controul of far more powerful energies than any of a merely terrestrial character or origin. It is part of the same system, the laws of which are not one jot affected by anything that can take place on the surface of the earth. The mere quantity, that is, the weight of matter in it, is the only property of it which comes within the general laws of the system; and however the volume, the combinations, or the other apparent qualities of the matter of the earth, may change, the quantity, as measured by the gravitation, must remain the same, unless altered by the direct interposition of the same Being that called it into existence. The orbital motion of the earth must remain constant, with the exception of those small variations in long periods of time which the influence of the other bodies of the system impose upon it, and the extent and limits of which are matters of certain and not very difficult calculation. Those variations are so small, and the periods over which they extend are so long, that they can have no effect whatever upon any part of the economy of the earth's surface during the life of man, or the whole time of man's history. Therefore, we may leave them out of view, and consider the grand seasonal action of the sun upon the earth as being at all times one and the same, as told in the different hours of the day, and the successive days of the orbital revolution.

We have this as an unquestionably sure foundation in all those speculations and inquiries into nature which are of a more general kind than the simple examination of that which comes before our eyes as mortals. Those speculations are by far the most valuable portions of the subject, for they lead the mind to immortality, and give it immortal hope, which is of far more importance than anything which is confined to our few years of trouble and vexation in this world.

In consequence of this general law of the system, which is far more immutable upon the earth than the laws of the Medes and Persians were upon the subjects of those departed and all-but-forgotten states, we may be sure that the general action of the seasons, as dependent on the sun, must have been the same in all ages, how differently soever the surface of the earth over the whole, or in any region, may have obeyed or been affected by that action. The existence of these last animals which have led us to these few remarks—and we regret that our limits will not admit of our following them out, and we do this the more that we believe the subject is but seldom brought before the public generally, even to such an extent as to call attention to it—the existence of these animals speaks of a time of forests and floodings; and we know that in all places of the world where these are, there are alternating periods of drought. During the flood we may suppose that the whole of the timber-destroying insects were swept away; but that, as the eggs of all are proof against every change of nature, and many of them are actually committed to the waters, there was always a store for the production of fresh myriads as soon as the

alternating drought set in, and the waters subsided. While the water was on the surface, and the insects gone, we may suppose that the large animals of which we have spoken were aloft in the trees, performing the same kind of operation which is now, to a less extent, performed by the sloths, that is, pruning the redundancy of the leaves, so that the trees might ripen their fruits and perfect their seeds. Then, when the rains were over, and the insects had come to maturity in their countless numbers, every tree on which the print of decay was set, and where the leaves had ceased to be succulent, the same animals may have descended to feed upon the spoilers, in order to prevent their dead bodies from being carried to waste by the returning waters. At the present time we have only what may be called partial remnants of this extreme of the working of seasons, but still we have enough to give us at least some insight into what must have been the earlier state of things.

The second tribe of this singular order of animals comprises two, or rather three genera; the *Armadillos*, of which an account will be found under the name ARMADILLO; *Oryctopus* (digging foot), a singular burrowing animal of Southern Africa, called the earth-hog by the settlers, and sometimes the *Aardverk*, or "earth-breaker," from the facility with which it burrows in the ground; and *Myrmecophaga*, or the ant-eaters, properly so called, of which some account will be found in the article ANT-EATER. Besides the ant-eaters, properly so called, there is an allied genus, the *Pangolins* (*Manis*), which are covered with imbricated scales, shaped like feathers in some of the species, and in all of them bare at their posterior edges. These last, from the form of their bodies, have been popularly called scaly lizards, but they are not lizards; they are true mammalia, only they are very different from the mammalia of what may be called our era of the world, which feed chiefly upon vegetable matters, or animal ones of larger size than the food of this, requiring to kill or crop their food, or, at all events, to divide or bruise it, and which are furnished with teeth adapted to the kind of food upon which they live.

All the genera of this singular order which we have hitherto enumerated are placental mammalia, bringing forward their young in an internal uterus, until they are completely formed; so that, if the order were arranged, as it might certainly be with some advantage to the system, these would answer to the placental mammalia which inhabit the world more generally, are adapted to all its latitudes, and in their various species to all the kinds of food which it requires, and which are the best known, and therefore to us the typical animals, one or other of which naturally occurs to the mind whenever the word mammalia is mentioned.

The remaining portion of the order, which have so little in common with the portion which has been mentioned, that they might as well be kept separate, are the *Monotremata*, or those which, like birds, have only one vent. There are but two genera of them, of which some account will be found in the articles ECHIDNA and ORNITHORHYNCHUS. They are marsupial animals, but all their habits are obscure, and nothing is known of the period of advancement at which the young are delivered from the internal uterus, though it has been ascertained that the females have a mammary apparatus for the suckling

of their young. It is worthy of remark, that all the existing edentata are confined to the southern hemisphere, or at least the exceptions are few.

EDOLIUS (*Drongo*). A genus of insectivorous birds, which were long, from their colours and other external circumstances, obtained chiefly from stuffed skins, referred not only to different genera, but to different orders, until Cuvier, from a careful examination of their structure, assigned them their proper place in the *Règne Animal*. In his arrangement, which, though not, in the nature of things, perfect, as no sagacity can supply the want of facts, is yet by far the best that ever was made, they belong to the dentirostral division of his great order *Passeres*, and to the fly-catcher family of that division. In that arrangement the dentirostral passeres follow immediately after the birds of prey, the shrike family taking the lead, and the fly-catchers following immediately after.

It is impossible not to admire this arrangement. The shrikes are actually, to a considerable extent, birds of prey; that is, they kill and eat birds, though they also eat other animals, as beetles, and the larger flies. The fly-catchers are also birds of prey, killing their own game, instead of living upon garbage, and picking up what they can find. Between them the distinction applies more to the size of the prey than to the habits of the birds; and if an eagle, which catches a hare—a falcon, which strikes down a pigeon—an owl, that mouses—and a small hawk, which catches beetles in its evening flights—are birds of prey, then the same name may, without much impropriety, be given to those birds which catch insects on the wing, which, according to our common notion of things, is a more noble sport than stealing an egg from a nest, or filching a caterpillar out of the curl of a leaf.

The characters of the genus edolius are: the bill stout, depressed at the base, a little compressed laterally toward the point, and furnished with a notch or tooth; the upper mandible slightly keeled, arched in the culmen, and hooked at the tip; the lower mandible straight, but inclining upward at the tip; the base of the bill furnished with long and strong bristles, directed forwards; the nostrils, near the base of the bill, lateral, and half closed by a membrane, which is concealed by the bristles; the feet short and feeble, furnished with four toes, the outer and middle one joined as far as the first articulation, and the hind toe stout, but shorter than the middle one; the wings of mean length, the first quill very short, the second shorter than the third, and the fourth or fifth, and sometimes the sixth, the longest in the wing; the tail in most of the species forked, rarely even, and never wedged.

This genus of birds are all natives of the eastern continent, and they are particularly abundant in India and the Oriental Isles, where they are usually seen near the shores of the sea, or the margins of the broad waters. They are great destroyers of insects, especially of bees, in pursuit of which they are active on the wing during the greater part of the day. They are in general gregarious, appearing in flocks in the morning and toward evening, but they spend the night and the heat of the day in the forests, their notes of salutation, when they leave their shady retreat, being often audible at a very considerable distance. Their cry upon these occasions is a sort of loud scream, in which there is not much music; but it is said that their love-songs, which they sing when they are apart, have a good deal of melody in them,

and those of some have been compared to that of the nightingale. As the birds are not together, however, it is impossible to institute a comparison, and there seems to be some tendency to overrate the musical powers of tropical birds. The reason of that may be seen without much difficulty. The sounds uttered by the tree-birds and tree-mammalia in those parts of the world are in general very harsh and disagreeable. The screaming of parrots, the chattering of monkeys, and the howling of the larger apes, to say nothing of the yelling of beasts of prey and the hissing of serpents, or the hollow roarings of crocodiles and alligators, are not the sweetest voices in nature. Hence, when any bird or other creature happens to strike up a noise which is even tolerable, the relief which it gives is music to the ear; and there is no doubt that this is one of the reasons why the songs of the drongos have been reckoned so sweet. They are no doubt at a considerable distance in the scale from those birds which have no love-song, or cry of any kind, save a chirrup or a scream, but they are not quite so far removed as to bring them among the songsters, properly so called.

They build their nests in the tops of the most lofty trees. The eggs, which are usually four in number, are rather large for the size of the birds, of a dull white colour, with black markings. The prevailing colour of the birds is black, with iridescent reflections of purple, green, and other colours; but as the reflected colours of birds do not come out except on near inspection, they appear quite black to ordinary observation. The flavour of their flesh is rank, so that they are of no use in an economical point of view. Their black colour, their screaming, their restless activity, and the offensive nature of their flesh, have procured them the name of "Devil's birds," which they are designated in many places, both by the natives and by Europeans. Vieillot gave the genus the name *Dicrurus*, double tail, or forked tail; but, as many of them have not that character, it is inapplicable. This is one instance of the injudiciousness of founding the name of a genus upon any one external character; for, if the genus is new, the probability is, that the character will not be applicable to it. Nor could there be, even admitting that the practice were a wise one, on the whole, a more absurd perversion of it, than to name a genus from the trivial circumstance of having a forked tail, which is common to so many birds. Other authors have classed the birds variously; some of them have been named, and even described as crows; others as rollers; others as cuckoos; and others again as shrikes; the last of which is near the truth, but even it is not correct, and the birds are really a distinct, and not a badly marked genus, both in their appearance and their habits. The generic name *edolius*, which Cuvier has given them, does not express much certainly, but still it leads to no mistake, and that is a matter of some consequence. It is perhaps not possible to find descriptive names for one-tenth of the genera of birds, or indeed of any other class of animals; and this being the case, the next best thing to be done is to give the genera names which shall be their own, and which shall not convey any erroneous meaning. We shall now mention a few of the species, remarking, at the same time, that, as the birds are exceedingly numerous, especially in the eastern Archipelago, the list cannot be expected to be complete.

EDOLIUS PUELLUS. This species was described as

a roller both by Latham and Temminck. It is a native of Java, and most likely of the other islands of the same group. It is about eight inches long: the male has the crown of the head, the neck, the scapulars, the back, and the upper tail-coverts of a very intense and brilliant azure blue; and the rest of the plumage is deep velvet black, with the bases of all the feathers brown. The bill and the feet are also black; the tail is rounded. The female has the ground colour of the plumage on the upper part blackish brown, with the tips of the feathers slate-grey, more or less intense, according to the age and condition of the bird. There are also blue spots on the back of the neck and various other places, and the middle of the back, the rump, and the belly, are often entirely blue, but never of so brilliant a tint as the same colour is on the male.

EDOLIUS BALICASSIUS. This species was named and described by Latham as a crow. Like the former, it is a native of Java: its length is about ten inches. The bill and feet are black, and the plumage also is black, with green reflections, which are very rich and brilliant on the upper part. The tail of this species is forked. The colour of the female differs from that of the male only in the black being less pure and intense, and the reflections less brilliant. This species is much on the wing and very noisy, while the depth of its black colour renders it very conspicuous. On these accounts it is one of those which are pre-eminently styled devil's birds. We believe the Malays have some superstition about it, and reckon the detention, and especially the killing of it, a certain means of getting bad luck.

EDOLIUS ÆNEUS. This species has been obtained from the continent of India, and there are some doubts whether it may not be the female of another species, as all the specimens which have come to Europe have been females. The brilliant reflections on the female of this species form rather an exception to the general character. The whole upper plumage is black with very brilliant and iridescent reflections of bronze green. The under part, the bill, and the feet are dull black.

EDOLIUS CÆRULESCENS. This is also an Indian species, by no means rare in many parts of the country. It has been long known to naturalists, and was described by Edwards under the name of the hook-tailed Indian butcher-bird. The length is about seven inches: the bill and feet are brown. The whole of the body-feathers on the upper part are deep black, with reflections of blue and copper-colour; the under part is black, passing into whitish on the belly. The wings and their coverts are brownish black, with a white spot on each of the first and second quills.

EDOLIUS PLATURUS. This species is from the eastern islands, though it has been described as an African bird. It is the Malabar butcher-bird of some writers, and the paradise cuckoo of others. These names are, of course, wrong, but from the redundancy of them it is probable that the bird is generally distributed over the south east of Asia. The length, taken from the point of the bill to the extremity of the second feather of the tail, is about eleven inches. The bill and feet are black. The general plumage is black, with iridescent reflections of green, the colour being less intense and the reflections less brilliant on the under side than on the upper. The bristly feathers at the base of the bill are very long and retroflected

toward the forehead, at their points: the tail is much forked, and the two outside feathers are considerably longer than the others, and they are peculiar in their form. The webs on both sides for a portion of the length near the middle, are very short; but beyond this they expand into two palettes or discs, which are turned round partially in a sort of spiral form. It is on account of these flat discs on the ends of the feathers, that this species gets the name of *platyrus*, or "flat-tail." It does not appear that this species is found so far inland or northward in India as some of the others.

EDOLIUS REMIFER. This species is found in Java and the other eastern islands, and also in India. It is not quite so large as the one last mentioned. The length from the point of the beak to the end of the middle feathers of the tail, is about nine inches. The greater part of the tail-feathers are of equal length, forming a squared termination; but the two outside ones are much longer than the rest, and peculiar in their form, for all that part of their length which they extend beyond the intermediate feathers, they have only rudimental necks; and thus they project beyond the squared extremity of the tail, like two little rods, or spines, tapering off to mere fibres at the points. The absence of the discs at the end of the produced feathers, makes this species to be at once distinguished from the last mentioned one. The reflected colours are also different: the upper colour is black with bright reflections of a very peculiar rust-coloured brown; and that on the under part is dead or flat black, without any reflections. The hairs at the base of the bill are long and velvety, and incline forward at the points. The bill and feet are quite black.

EDOLIUS LEUCOPHÆUS. This species is found in Java, in Ceylon, and also in India. In its colour it differs considerably from any of those which we have noticed. The general colour of the plumage is one uniform tint of dark leaden grey; and the bill and feet are of the same. The coverts of the wings are blackish brown, and the outer webs of the quills black. The tail is long and much forked. The entire length of the bird is about nine inches. Though more calm in the tints of its plumage, this is one of the most active and graceful on the wing of the whole genus.

EDOLIUS MASERUS. This is a native of the shores of Southern Africa. It is between eight and nine inches in length. The general colour of the plumage is black, with much less brilliant reflections than any of the others. The inner sides of the quills are grey for the greater part of their length, and brown at the points. The tail is very slightly forked.

EDOLIUS FORTIFIRATERS. This is another South African species, being found not unfrequently near the shores in the colony of the Cape. It is larger than the former one, and more brilliant in its appearance. The length is about ten inches; the bill and feet are leaden black; the general colour is black, with very bright green reflections. A crest is formed by long and straight feathers which rise in front of the forehead, and bend forward over the bill. It is a very handsome as well as a very active species.

EDOLIUS MYSTACEUS. This is also an African species, about the same size with the preceding, but it differs in colour and in the situation of the produced feathers. The general plumage is black, with green reflections, not quite so brilliant as those of the for-

mer; but the wings and tail have a shade of brown in them. The bill and feet are also black. There are two tufts of produced hair-like feathers, which form a sort of mustachoes close by the bottom of the gape. The female has some white spots on the belly.

Such are the specimens of this very peculiar genus of birds,—birds which have the general form of the fly-catchers, and the bill not unlike that of the shrikes; but they have not the habits or the colours of either. They are more social, more noisy, and seek their food more by continued flight in the open air. The times when they are understood to be most on the alert, are those when the bees are setting out for their pastures, and again when they are returning home.—They do not confine themselves to bees, however, but are very active in capturing many of the other insects with which the shores and margins of the tropical countries abound so much. They have few or no attractions as cage birds, and they are not at all tempting as game; but still they give a great deal of liveliness to the places which they haunt, and may be considered as forming a feature in the scenery on the tropical shores of the eastern world.

EDWARDSIA (Salisbury). A genus of highly ornamental shrubs introduced from New Zealand. Linnæan class and order *Decandria Monogynia*, natural order *Leguminosæ*. Generic character: calyx pot shaped, cut or rent above, remains of the margin five-toothed; corolla standard connivent; keel obtuse, a little longer than the wings; stamens imposed on a discous ring round the germen; style filiform, protruding; pod beaded, square, many-seeded. This genus is nearly allied to *Sophora*, and is what may be called half-hardy. They do well trained to a south wall, if the root be protected in winter. It may be propagated by layers, cuttings, seeds. The latter ripen frequently.

EEL (Anguilla). A genus of soft-finned fishes without ventral fins, of which the general appearance is so familiar to every body, and so different from that of the majority of fishes, that it requires no particular description. In the articles *ANGUILLIDÆ* and *ANGUILLA*, in their proper place of the alphabet in this work, there will be found some particulars relating to the general characters of the family, and to its subdivision into genera; and under the word *MURÆNA* we shall give some account of those species which inhabit the sea, and which, independently of the fact of their being salt water fishes, have other characters sufficient to warrant their separation from the fresh water eels, which are the true eels, and to which we purpose to restrict the remainder of this short article.

In many points of view, eels are a highly interesting genus of fishes. They are exceedingly numerous, they are found in almost every part of the world, they are wholesome and agreeable as food, and many of their habits are very peculiar. Nor are they interesting only for the truth, which is now tolerably well established, with regard to all their leading habits, for they are almost equally interesting in consequence of the prejudices on the part of people generally, and the blunders on the part of naturalists, of which they have been the innocent causes.

The serpent-like shape of an eel, and the fact of its living generally at the bottom of the waters, and in mud if possible, caused it to be mixed up with all the prejudices which mankind have entertained against the serpent tribe; and so inveterate appears to have been, and in many cases still to be, this prejudice,

that even Pennant, whose industry is at least a strong ground of palliation for his blunders, appears not to have been able to divest himself of the notion that there is a spice of the serpent in the habits and disposition of the eel, as well as a slight resemblance in the shape. It may not be amiss to give the substance of the passage, as containing a very remarkable admixture of truth derived from observation and error begotten by prejudice. "The eel," says Mr. Pennant, "is singular in several matters relating to its natural history, and in some respects borders on the reptile tribe; the eel is known to quit its element, and during the night to wander along the meadows, not merely for change of habitation, but also for the sake of prey, feeding on the snails in its passage; during winter it beds itself in the mud, and continues torpid like the serpent tribe, is very impatient of cold, will eagerly seek shelter in a wisp of straw flung into a pond in severe weather, and which has sometimes been practised as a method of taking them." This does not go quite the length of the common saying, which however is applied ironically to persons who are not over wise, that they would answer well for "catching eels among green barley;" though Albertus goes the length of saying that he had actually seen them leave the water and take up their abode during the night in a hayrick, where, however, they did not find a place of safety, inasmuch as they died of cold before the morning. That eels do avoid the colder parts of the water at certain seasons of the year is no doubt true; but, as we shall see afterwards, the reason of it is physiological rather than a mere avoidal of the cold for their own personal comfort. Indeed if some of the reports, which are stated as from personal observation be true, eels are capable of being frozen up during the cold weather. This, though singular, must not be regarded as an impossibility; for it is very probable that eels pass the very cold weather, at least in cold countries, in a state resembling hybernation. The account of the freezing of three eels was given by Mr. Swallow, who was a good many years ago British consul-general in Russia. "Having," says he, "occasion to go from Petersburg to Moscow, where eels are a great rarity, he ordered some to carry as a present; upon being taken out of the water, they were thrown upon the ground to be frozen, and soon appeared quite dead, and almost a piece of ice; they were then packed in snow, and when he arrived at Moscow, which was four days after, the eels being put into cold water, and so thawed, discovered gradually signs of life, and soon perfectly recovered."

The supposed relationship between eels and serpents very naturally led to the imputation of the former of many of the fables related of the origin of the latter. It was a very general belief, in ancient times, that serpents of the most deadly venom were bred out of the mud or slime of the Nile and other flooding rivers of warm countries, when the drought set in and the waters subsided, leaving a sediment upon the banks, replete certainly with the germs of small life of various kinds, but quite incapable of itself of originating the most tiny insect. It was observed also that other poisonous reptiles brought forth their young alive; and the two characters, though the one was purely fabulous and the other real, were jumbled together in the supposed production of eels. It may not be amiss to quote from a very impartial compiler an abridgment of those opinions, the more so that some of them have been maintained by writers on natural history,

otherwise judicious and deserving, and that down to the present time; for it is only within these few years that Mr. Yarrell, whose researches have cleared up many important points in the economy of the animal kingdom, and especially in that of fishes, demonstrated in the most clear and conclusive manner that the generation of these fish takes place in the same way as that of all fishes which are very prolific, namely, by spawning. "The ancients," says the account which we quote, "adopted a most wild opinion about the generation of these fish, believing them to be either created from mud, or that the scrapings of their bodies, which they left on the stones, were animated and became young eels. Some moderns gave into these opinions, and into others equally extravagant; one in particular gives instructions for producing them by art:—'Cut up two turfs covered with May dew, and lay one upon the other, the grassy side inwards, and thus expose them to the heat of the sun; in a few hours there will spring from them an infinite quantity of eels;' not imagining the possibility of water being supplied with fish, by the conveyance of the spawn by aquatic birds of prey, in a similar manner as vegetation is spread by many land birds. As to their immediate generation, it has been amply proved to be effected by the ordinary course of nature, and that they are viviparous. Many persons have convinced themselves of the fact, by opening and taking from the eel a small soft whitish substance knotted curiously together; upon being put into water this has separated, and the young eels were perfect, and, though not bigger than a small thread, have swam about; this discovery always took place the end of summer or the beginning of autumn, and has been adduced as a confirmation of their going down to the salt water to spawn. Those that remain in the rivers, or that have been carried by floods into rivulets and ditches, of which some are to be found at all times, produce the young in the same way." The catalogue of absurdities with regard to the production of eels might easily be extended to a very considerable length; and though it is not our intention to record the details of these, yet their number and the inveteracy with which many of them are believed, even in our own times, render it necessary to take some notice of them. When it is found that prejudices of this kind are general among many nations, and continued through the lapse of ages, it showed that there is something like truth in the foundation of it, and these are precisely the cases in which writers, who address themselves to the great body of the people, should exert themselves to the utmost in removing the ground of the prejudice. One of the most singular errors of public belief, with regard to the production of eels, is that they are formed of the hairs which drop from the tails of entire horses which find their way into the water. The hair, according to the belief, is first converted into a species of *Filaria* or thread-worm, the *Gordius aquaticus* of Linnæus, which is exceedingly common in small brooks and pools, especially after summer showers. This animal is not thicker than a moderate sewing thread, and about four or five inches in length, swimming about with considerable activity, and often twining its body into very curious knots. It belongs to the leech family, or rather is closely allied to them; for though its body is formed of rings, it is not extensile and contractile, like that of the leeches, neither is it provided with any sucking apparatus, so far as is known. Yet this creature is, in many

parts of the country, believed to be in due time transformed into the common eel, and sometimes also into the lampern or lamprey, a belief in which there is of course no foundation. Even this is not the only method in which, according to the belief of those who have some pretensions to science, *filaria* have been considered as young eels. The belief of eels bringing forth their young alive was very general till more than one-fourth of the present century had elapsed; but though it was tacitly concluded to be true, nobody was in possession of very decided evidence of the fact, as indeed they could not, the fact itself being the other way. Eels are infested with many kinds of *entozoa* or worms, which feed upon the substance of their intestines. Of these, the most conspicuous is the *Echinorhynchus tereticollis*, which insinuates its head very often through the internal and middle coats of the intestine, and there remains with the head forming a round lump visible externally, and the body floating in the vessel. These are generally whitish or yellowish in the colour, and are certainly very unlike in shape to eels in any stage of their growth; but still they have been described as the young of the eel in a certain stage of their growth. A more probable species of young eel, in progress for delivery alive, was, at least in so far as shape was concerned, found in the intestinal *filaria* which infest the eels, and are often found free in the vessel, and moving about with considerable activity, and if in a fluid with something like an eel-like wriggle. These were very confidently regarded as being young eels; and as the sexual differences of the fishes had not been attended to, the eel was set down as an animal of double sex, bringing forth its young alive.

In the foundation of this opinion, which was stated with the greatest confidence, there was one little matter which might have prevented the error. Those living creatures were invariably found in the digestive organs of the eel, and never in any separate cavity or viscus, which appeared to be prepared by nature for the bringing forward of a viviparous progeny, or even maturing an oviparous one, such, for instance, as the roe of a fish. Now, though there have been instances of extra uterine impregnation, and also gestation, so far at least in even what are considered the more perfect of the warm-blooded animals, these have always been properly considered as monstrosities or departures from the course of nature, instead of being parts of that course. Nor even in the most simply organised living creatures with which we are acquainted, is there any instance of the young being produced in the stomach, or in any part of the whole intestinal canal. Indeed, if we consider for a moment, we may see that the natural functions of this canal are directly opposed to, and therefore incompatible with any species of reproduction. The whole of the digestive apparatus is a decomposing apparatus in respect of every thing received into it; and, in animals of vigorous stomachs, there have been many instances of partial decomposition of the viscus by its own action in cases of great privation of food. It is true that *entozoa* breed and live there, and that though we know but little of the peculiar mode of their production, *filaria* are apt to breed in the cerus cavities of very many animals; but animals which breed and live in such places, unless they undergo transformations afterwards, are not fitted for living any where else, and we could not by possibility imagine them to be so metamorphosed as to assume the habits and per-

form the functions of those very animals on which they are parasitical. If these considerations had been duly weighed, they would have been decisive against the possibility of eels being viviparous; but it has often happened in natural history, that a theory founded upon even the most ridiculous prejudice, or even upon a description attempted to be made fine by some one possessed of more words than understanding, has been maintained so resolutely as to defeat even the direct observation of the maintainer, to say nothing about the general analogy of nature, in which certain definite functions always accompany a certain definite structure.

The peculiar migrations of eels, which are of too striking a character to have been overlooked, even at periods comparatively remote, might have led to sounder conclusions with regard to the mode of their reproduction; but for a very long time no attempt was made to generalise what was observed in this way, or even to ascertain for what purposes fishes, which at other times remain so silently at the bottom of the waters, undertake journeys of very considerable length, and pursue them with a determination rarely equalled by any other race of animals. Here, also, a general analogy of nature was lost sight of, which, if followed out, would have certainly led to the facts of the case. From time immemorial, it has been well ascertained, that in the autumnal months, taking October as the average of the British islands, eels which have access to the streams of rivers, invariably descend towards the sea. In ponds and stagnant waters which have no permanent outlet, the autumnal migration does not, of course, take place to the same extent; and yet if the pond is not too far removed from running streams, it is highly probable that some portion of the eels make their escape from it during the autumnal rains. It seems, too, that those which do not so escape, feel no small inconvenience from the cold of shallow ponds, if the winter is at all severe. We have understood from what we consider as being undoubted authority, that in some ponds of considerable extent, but no great depth, in Beddington Park, near Carshalton, in the county of Surrey, the eels have not this means of escaping in the autumn; and that not many years ago, a young man lost his life from cold, in consequence of catching eels in those ponds during the severe weather of a rigorous winter. He used to break a hole in the ice, and descend nearly up to his middle in the cold water; and the eels, appearing to be attracted by the warmth of his body, came clustering round his feet and legs in great numbers, so that he could take them with the hand in almost any quantity, using a bit of sand paper to give firmness to his grasp. He found this kind of sport so very successful, that he pursued it, until the water, from its cold, had so severe an effect upon his own system, that he died. This is a very curious fact in the natural history of eels, and shows that, even if they can, as alleged in the case of the Russian ones, endure being frozen without loss of life, they are very sensitive, even to a very moderate degree of heat, when shallow water is so far cooled down as to be frozen over on the surface. In the deeper lakes, which do not freeze even in our severest winters, and from which an outlet is not easily found, it is probable that the eels find a winter asylum in the deeps, where they in all probability bury themselves in the mud during the inclement season; and it would be an interesting problem to ascertain whether those eels which are cut off from regular migration,

breed as often and are as prolific as those which have free access to the estuaries, and can pursue their autumnal journeys without much difficulty; but as it is difficult to reach eels in those deep waters, the point is one which cannot be settled without the most careful observation.

The annual descent of the river by eels, at nearly the same season when salmon and other fishes which spawn inland are ascending, has been ascertained in very many parts of the country; and we believe it is most remarkable in rivers which pass through no lakes of very considerable magnitude, or in those which flow by short courses from lakes to the sea. The river Ban, in Ireland, which flows from Lough-Neagh to the North Sea, has been long famed for its eel fisheries. Many years ago the fishery of this river is represented as having let for one thousand pounds a-year; eels of the weight of nine or ten pounds being sometimes taken, and the time of finding them in the river, at least in numbers, was during the autumnal rains, while they were descending, and we believe that, long before the subject was thought of by professed naturalists, the fishermen on the Ban were in the habit of considering, as a matter of course, that the eels descended to the sea in order to spawn, in the same manner as salmon and trout ascended the river for the same purpose. Nor was this all that was known of the true history of the fish by those fishermen, for they were in the habit of suspending ropes of straw across the falls and rapids, in order to assist the young eels in their ascent during that part of the summer when this movement takes place.

On smaller rivers, the greater part of the water of which, except during floods, is taken to the mill courses, the millers have long known how to carry on a very successful eel fishing with very little trouble during the autumnal ascent. There is one stream in Forfarshire where we have seen this fishing carried on to a very great extent. This stream is the Vinney, which flows eastward and enters the British sea in the bay of Lunan, between Arbroath and Montrose. The principal stream originates in, or passes through, a number of small lakes, containing great quantities of peat and marl, and apparently particularly favorable for the pasture of eels, which are found in vast numbers both in those lakes and in the pools of the rivulets which discharge their waters into them. Marvellous stories are often told of the size and formidable character of eels which are obtained in those small lakes, when partially drained, in order to obtain the marl by digging, and not by drudging; and we have often heard of eels ten or twelve feet long, as thick as the calf of a man's leg, and capable of leaving the impression of their bite in a steel spade. Of course these are exaggerations, but they serve to show the district alluded to is not only a great eel country, but a country of great eels. Well, in autumn, especially when it is moonlight, for the eels are understood to like to see their way, though night wanderers, the millers open the sluice of the mill pond, or rather it does not require to be shut during the autumnal rains, and place a large basket to receive all the water of the "off-shot," the whole being stopped and turned into that, at the point where it would descend on the wheel. In the morning it is no uncommon thing to find a hundred weight of eels, or even more, in one of these baskets; and, we believe, that it is either a point of justice or of honour among the millers, that they shall all take their turn

during the migration, so that he who lives farthest up the water-way may not enjoy a monopoly to the injury of the rest.

The accounts which have been long known of other places are nearly the same. In Scotland, in the neighbourhood of Linlithgow, is a considerable lake, in which great quantities of eels are caught by hooks and lines during any of the summer months; but the principal fishing is in the month of October, when it is found that the eels, directed by natural instinct, discover an irresistible propensity to issue from the loch by the passage through which the water flows from it to the sea. In October, the person who rents the fisheries puts into that passage a kind of chest, so formed as to allow free passage to the water, while it stops those eels that exceed a certain size. This chest is every morning emptied of its fish, which are sometimes in such abundance as to require carts to carry them away. This fishing continues about a month, before or after which time few or none can be so taken: the chest is then removed, and the passage left free.

In Wiltshire, about Warminster, where the rivers are smaller and more rapid in their course than in many other parts of England, the mills placed on the streams are numerous, and the water is carefully directed into one channel. The persons possessing these mills having discovered that numbers of eels go down the river during every flood happening in October, have devised a box which they call an eel-grate; this is placed in a convenient part of the river, and thus great quantities of eels are caught. They also find, that no eels worth mentioning can be taken in this way at any other season of the year.

Whether the eels thus caught in descending the river are near the breeding time, was not for a long time ascertained, though the fact is now established that breeding is the grand purpose for which the descent takes place. It has been clearly ascertained by repeated observations, the accuracy of which cannot be questioned, made in very different parts of the country, that eels invariably descend the rivers to the lower estuary, wherever such a purpose is practicable. The fact that they were found in vast numbers in the ooze and sludge, or sand of such places, was well ascertained for many years previous to the time that naturalists began to inquire what brought them there. Sludgy mud, or what is usually termed a fat beach, from which the tide ebbs to a considerable distance, but which is still full of stagnant pools and runs of water, even at the ebb, are the favorite places for them. There they lie during the cold weather, buried under the surface, and matted together in clots; and there are many places where great numbers are caught during the winter between the prongs of barbed spears, which are pushed along the soft sludge until it is ascertained that they have taken a sufficient load. This is, we believe, very extensively practised in the bay of Southampton, and at the mouths of many of the moderately sized rivers of other parts of the south of England; but though not unknown in the northern parts of the country, it is carried on less extensively there. The fact is that, in the northern parts of Britain, in Scotland especially, the prejudice of the people runs very strong, not only against the form of the eel, but against the quality of its flesh as an article of food. It may be that, in the latter respect, the eels of cold, and especially of moss-tinged waters, are much inferior to those of clear streams, or of those balsamic waters which acquire a golden, or, at all

events, an amber-coloured tinge, from the great quantity of rich loam in a state of very minute division, which they hold in solution. The substances upon which eels feed acquire a very remarkable difference of character, from difference of water and its deposits; and the worms which are brought in by the streams on pastures composed chiefly of sand mixed with peat earth, are so pale in the colour, so hard and unpalatable, that even the hungriest trout in better places spurns them as unworthy of his palate. How much there may be in this, we do not know, but certainly eels are held in small estimation in the north, and even discounting their serpent form, they are regarded as far from wholesome. In some places, indeed, they rate at what is usually considered "cat's price," that is, they are worth nothing but the skin; but in proportion as the flesh of the animal is despised, it is probable that the skin rises in value. The bare-footed cow-boys of the Scotch hills may run with any velocity they choose across the most stony pastures without breaking or injuring a single toe, if each ankle is defended by a circular amulet of eel-skin; and if even in her tender years a girl goes to the severe labour of the harvest field, her feeble arm never experiences the very painful sickle sprain if she has it defended by a bracelet of the serpent-looking fish. Nay, in the case of any of these contingencies having already happened for want of this invincible skin, its curative power is so great that it will not only take away the grief of the hurt instantaneously, but effectually cure it in briefer space, and with far more certainty, than the whole fraternity of body curers, with the entire *materia medica* to boot. These superstitions point to some interest about the fish, which is, no doubt, in part owing to the obscurity of its manners; and had we not so many proofs that prejudice bewilders and leads astray in proportion to the depth of the impression which it makes, we might be tempted to suppose that the attention which the eel commands would long ere the present day have led to a knowledge of its economy and manners.

That the eels in their annual migrations "descend upon the heat," or that they seek water of a higher temperature than that from which they retire, is not only probable, but certain, though the ultimate purpose which this migration answers in their economy is physiological, not physical. In all the movements in animals, indeed, whatever may be the ultimate purpose for which they move, the primary cause, as affecting themselves, is physical; and it cannot be otherwise: for to suppose that they are capable of looking forward to the physiological result, would be to suppose them endowed with forethought plan, and, consequently, with the faculty of reasoning upon cause and effect. As regards the animal, the movement, whether to a greater or less distance, goes not beyond the fact which we observe; and the finding out of the physical purpose which this movement answers, is the business of man, the observer, and not of the animal observed.

We know that, in consequence of a slight compenetration, or lessening of the total bulk taking place, where the fresh water of a river blends with the salt water of the sea, there is constantly a small portion of heat given out in the brackish water which the mixture forms, and because of this giving out of heat the brackish water is warmer than either the fresh or the salt. This fact tells not only in the collection of fishes of various kinds to this part of the waters, in

order to bring their roes and milts to maturity, but also in the superior vigour of all vegetables on the banks, along that portion of the tidal estuary in which this brackish water plays backward and forward, at least to some extent, with the ebb and flow of the tide. There is another reason which not only brings fishes, but, in the winter season, the aquatic birds to these places of the rivers. It is between the river and the sea that all the light and loamy, and consequently rich matters which the rivers bring down, are deposited in the channel; for it is only the particles of washed sand which have sufficient firmness and weight for being carried out to sea, even to form a bar in the salt water along the river's mouth. Now the quantity of small animals, worms, mollusca, small crustacea, insects, and others which are produced in those rich deposits, and even brought down to them by the fishes, is very great, and forms an abundance of food, both for the fry of fishes, and for the aquatic birds. But though this is somewhat different from the mere fact of the greater heat of the water at such places, it co-operates in producing the general result.

It is not for the mere purpose of depositing their spawn that fishes resort to this portion of the waters, but rather for the purpose of bringing it to maturity, so that it may be fit for being deposited. In this we have a means of judging of some very important differences in the habits of fish; and there is, perhaps, none more worthy of attention, at least in the British islands, than salmon and eels. The salmon is a fish of the free waters, seldom lying at the bottom, even for the purpose of repose, and it swims with greater velocity than almost any other river fish, though the strength of its exertion soon exhausts it. The eel, on the other hand, is a bottom fish, rarely if ever coming to the surface. It is comparatively slow in its motions, but capable of very long continuance; and, indeed, in all things it is a fish of very great endurance. The salmon spawns in the latter part of the year, before the frosts set in, and while the inland waters in the brooks and shallows, having been acted on by the sun of the whole season, are comparatively warm; therefore the salmon ascends the estuaries during the time of the growth of the spawn, and that is deposited as far in the interior as the fish can reach. The eel, on the other hand, spawns in summer, earlier or later, according to the latitude, and the character of the river in whose estuary the operation takes place, being in May in the rivers of the south of England, but not earlier than June in the more northerly parts of the country. These facts have been ascertained by actual observation of a number of eels of both sexes, in the progress of the spawn to maturity, in its fully matured state, when in the act of shedding, and when immediately shed, in the last of which cases, eels follow the general law of all fishes, and are quite exhausted and unfit for food. In what way the spawn is deposited has not been ascertained; but from the habit which the animals have of burying themselves in the mud, it is probable that they bury it to such a depth in the ooze of the shallows, as that it is not disturbed by the agitation of the waters. It is known, however, to be very abundant in quantity, and, indeed, there is, perhaps, no fresh water fish so prolific as the eel; and for this reason, it might be worth while to attend to the artificial rearing of eels more than has hitherto been done. It is partly with a view to the breeding of those fishes for economical purposes, that the ascertaining of the mode in which they breed is a

point of so much importance ; for until this fact was made out, it is evident that any attempt to treat them artificially could be no better than mere guess-work. In all fishes, indeed, which are reared in ponds or other artificial waters for economical purposes, it is absolutely necessary that the economy of the fishes should be well understood.

How the eels dispose of themselves after spawning time, whether they ascend the rivers again during the same season, or remain a season or more in the brackish water, or in the lower part of the river, in order to recruit their strength, has not been ascertained ; though there is some reason for thinking that they do not breed every season ; and, indeed, this is, probably, the case with a great number of fishes, especially with those which are migratory in the breeding season. Some of the large eels have been observed ascending the currents of rivers ; but they have not been so observed in any thing like such runs as on their descent. This might, perhaps, be expected, at least in might be so, from the analogy of other fishes. In the salmon, for instance, we know very little of their descent to the sea, after spawning in the inland waters, though there is no doubt that, in consequence of their numbers, in rivers favourable to them, many must descend, notwithstanding the numbers that are taken. They appear, however, to get to the sea in the speediest manner possible ; and for this purpose they keep the middle of the stream, and do not, perhaps, come so near the surface as when they are on their ascent. In ascending the estuaries and larger rivers, the salmon are generally at no very great distance from the shores, as they have there the advantage of the eddy water, against which they can make way more rapidly than they could do against the stronger current in the main channel of the river. One would naturally suppose that the eels would also make their ascent near the shores, to have the advantage of the eddy, and probably this is the case with the old ones, as it is known to be with the young. It is not near the banks that the eels are taken in such numbers while descending the streams, it is where the whole of the current can be received into a net, or basket, which allows the water to pass through, but retains the fish.

But though the time and manner of the eels which have spawned ascending the rivers, has not yet been clearly made out, the case is different with the young fry. In the larger rivers, and especially in those which flow through places so rich in small particles, as to have their waters generally tinged, the march even of these is not seen ; but in the clear rivers they have been observed, and observed in such numbers as to demonstrate that the fishes spawn in the lower parts of the rivers, and also that they are exceedingly prolific. Unless when swollen by rains, the river Dee, which empties itself into the sea at Aberdeen, is remarkable for the transparency of its waters, and perhaps there is no stream of equal magnitude in the island, where the movements of fish can be better observed. At the season when the salmon are ascending, one may stand on the old bridge and see them moving up the stream in a continued shoal, which continues for a long time. In the same river the ascent of the young eels from the sea has been described by an eye witness in the following terms :—" I know, and it has been observed by others, that in the month of June, yearly, immense swarms of young eels make a progress from the lower part of the river towards the

higher, with a quickness and unremitted assiduity that are surprising. This phenomenon was remarked in the river Dee, in Aberdeenshire. The eel is a fish that seems (unlike the trout) to dislike running streams, and therefore avoids that part of the river where the current is strong. It had, probably, been this circumstance that induced them, in the rapid Dee, to direct their progress only along the edges of the river close to the banks. A line followed the windings of the river, being often suddenly deflected by stones or other interruptions without any breach of its continuity. This line having frequently caught my eye, my hand was put into the water to touch the line, with a view to examine what it was : the line became discontinued when my hand approached ; but it united again as soon as my hand was withdrawn. This induced a nearer examination ; and I then perceived, with astonishment, that this line was formed by a series of small eels, moving forward with great celerity. These eels did not exceed half an inch in length, but were in all respects perfectly formed like the common eel. The line might, perhaps, on an average, consist of from twenty to thirty in breadth, and the individuals being in different degrees of forwardness, and close to each other, made the line uniform. The progress with which they advanced was not less than four miles an hour ; and this continued for eight days and nights together ; and there was no apparent diminution of it when I left the place. There was a similar line on the opposite side of the river. The water in which they floated at the place where I observed them was, in general, about two or three inches deep."

In the lower part of the Thames, though that is a good eel river, the motions of the young eels upward cannot be so easily observed, because of the quantity of mould which is generally suspended in the water. This circumstance is, however, as favourable to the breeding and security of eels, as it is unfavourable to the observation of them. There is one place in the river where, however, they may be seen in great numbers, and this is at Teddington lock. The river is, generally speaking, rather low at the time when they reach this obstruction on their passage outward ; and they have been observed climbing up not only the weir, but the wooden posts with very considerable adroitness, so as to gain the water above. We believe that those climbings are generally performed during the night, and consequently, they are not observed to their full extent, though when the sky is overcast, considerable numbers of them make their passage upward during the day ; and it is on these occasions that they are seen, and seen in sufficient numbers to prove the fact in this river, as well as in others.

To what height an eel can climb in making its way up the rivers has not been ascertained ; but as they are found much higher up than salmon, it is probable that they can scramble up the rocks by the side of waterfalls, which are too lofty for the leap of that active fish. Indeed, there are some well-authenticated instances of eels making their escape from ponds, either where there was an overstock, or in consequence of the natural instinct of getting to the brackish water, by climbing trees, especially weeping-willows having the points of their pendent branches in the water of the pond. The eels ascend those branches pass the bole of the tree, and then descend the branches on the other side. If they find water at or near the

extremities of those branches they soon get into it, and make their escape; but they frequently ascend, and are found crawling and wriggling about in the meadows, where also they can move to a considerable distance, especially if there are little pools, which serve them as a sort of inns, or resting places, on their way. In consequence of this power of climbing, and also of moving over land, eels are much more capable of distributing themselves generally throughout all the waters of humid places, than perhaps any other kind of fish. On these migrations, and also when they are ascending the shallows near the banks of the rivers, vast numbers of them are seized by herons and other wading birds. Indeed, where they are numerous, eels are the favourite food of the heron; and after a summer shower has favoured their ascent into the upland brooks, herons may be observed watching for them with great assiduity, in places where there is no heronry within many miles. See the article HERON.

In countries farther to the south, eels are still more abundant than they are in any part of Britain; and in those places they form no inconsiderable part of the food of the larger wading birds, such as cranes and storks. They are exceedingly numerous in the river Po, as the lagunes and banks at the mouth of that river, on the latter of which the city of Venice is built, are peculiarly favourable as breeding places for them. In no place, however, is there any danger of confounding fresh water eels with those which are permanent inhabitants of the sea, and never ascend the fresh waters, though, like the others, they appear to resort to the shallows and brackish waters for the purpose of breeding.

The general characters of the whole of the eel family, which is a very natural one, are, the body elongated, the skin very thick, generally without any scales, and rendered exceedingly slippery, by a mucous secretion; their intestines are without any cæcum, and the greater number of them have air bladders. The true eels have the pectoral fins very far forward, and the gill openings, which are very small, placed immediately under those fins; the stomach, or long cul-de-sac, and the intestine, nearly straight; the air-bladder very much elongated, and with a gland placed at the middle of its length; and they have the dorsal fin beginning at a considerable distance behind the pectorals. The fresh water eels have also the upper jaw shorter than the lower one, while the sea eels have the shorter lower than the upper, and in them the dorsal fin begins much nearer the pectorals than in the fresh water eels.

This difference of structure in regard to the commencement of the dorsal fin, shows that the two are fitted for progressive motion of a different kind. The pectoral fins in the fresh water eel keep the head steady to its course; and the portion of the back which is without a dorsal, obeys the motion of the head, so that the fore part of the fish can proceed steadily in a straight line, at the same time that the body, behind the commencement of the dorsal, performs those motions which are necessary to project the whole forward. In both the sea and fresh water eels, the dorsal and anal fins meet at the extremity of the tail; and thus the whole of the posterior part of the body is a sort of paddle, by means of which they work themselves along, something in the same manner as a boat is worked along by sculling with one oar, worked right and left across the middle of

the stern. In the British waters there are, at least, two species of fresh water eels, which are distinguished as the *sharp-nosed eel* and the *broad-nosed eel*. The colours of both these are nearly the same; but the broad-nosed one is rather thicker in proportion to the length, and has the head larger and the gape wider. It is also said to be fuller of flesh and more juicy than the other, though this, no doubt, depends in a great measure upon the season at which it is taken, and the water which it frequents. There is nothing, however, so strikingly different in either the appearance or the habits of those two species, as to call for any particular description of them as distinguished from each other.

The great interest of these fishes is in the peculiarity of their manners, and the mistakes and absurdities which have so long prevailed on the subject of them. There is, indeed, another point of view in which they are worthy of some consideration: it is probable that before many years have elapsed, eels may be the only fish obtainable in the lower parts of those rivers where our great manufacturing towns are situated, and where the refuse of gas-works, and countless other impurities are continually discharged into the water. Those impurities generally float on the surface, or, at least, very near it, and thus they are fatal to salmon, trout, and all other fishes which swim near the surface; but if the water is of any considerable depth, the eel is sufficiently far down to breed in safety.

EGLANTINE is the *Rosa eglanteria* of Linnæus, a wild species of rose common in many parts of Europe. A bramble introduced from New Holland in 1825 is also called eglantine.

EGYPTIAN LOTUS is the famous *Nymphæa Lotus* of Linnæus, a magnificent aquatic plant, abundant in the Nile, and in most of the tropical and other rivers of Africa and Eastern Asia. The leaves are ample, peltate, and mostly float on the surface of the water; the flowers are large and showy, and the main stems of the plant creep in the mud, are jointed tubers and esculent. The canals in China are in some places literally choked up by this plant, but it is in that empire an inexhaustible source of food for the poorer inhabitants, who use the tubers as potatoes are used in Europe. The order *Nymphæaceæ* is pretty generally distributed. The *Nelumbiums* of Africa and China, the *Nymphæa* (water-lily) of Europe and America, and the *Euryale* of India, are all included in the order. The *Nymphæa nelumbo*, now called *Nelumbium speciosum*, was first flowered in England at Bulstrode, the seat of the Duke of Portland, about the year 1790.

EGYPTIAN THORN is the *Acacia vera* of Willdenow, an ornamental tree, native of the northern parts of Africa.

EHRETIA (Linnæus). A genus of tropical trees and shrubs, belonging to the fifth class of Linnæus, and to the natural order *Ehretiaceæ*. Generic character: calyx five-toothed, or cut irregularly; corolla bell or funnel-shaped, limb five-cleft; stamens having awl-shaped filaments inserted in the tube; anthers two-lobed at the base, two-celled, and protruding; style divided, bearing acute or obtuse stigmas; drupe bony, two-seeded, sometimes four-seeded; embryo inverted. These exotics thrive well in the bothouse, and are easily propagated by cuttings.

EHRETIACEÆ. A natural order of dicotyledonous plants, containing only a few genera and

species. By many authors it is considered as a section of *Boragineæ*, from which, however, it is distinguished by its terminal style proceeding from the apex of a perfectly concrete, four-celled ovary, and its berried fruit. By others it is included under *Cordiaceæ*. It bears an affinity to *Heliotropiceæ*, from which it differs chiefly in its succulent fruit.

Its essential characters are: calyx inferior, five-parted, with an imbricated æstivation; corolla monopetalous, tubular, with as many segments of its limb as the calyx, and also with an imbricated æstivation; stamens alternate with the segments of the corolla, and equal to them in number, arising from the bottom of the tube; ovary simple, two or more celled, seated in an annular disc; stigma simple, two-lobed; fruit drupaceous, with as many stems as there are true cells of the ovary; seed suspended, solitary; embryo in the midst of their fleshy albumen; radicle superior.

The plants belonging to the order are trees or shrubs with a harsh pubescence, simple alternate, exstipulate leaves, and corymbose flowers. They are found in tropical regions in both hemispheres, and are not distinguished for any important properties. The chief genera are, *Ehretia*, *Tournefortia*, *Rhabdia*, and *Bourreria*.

The root of *Ehretia buxifolia* has a sweetish and somewhat warm taste, and is used in India as a tonic and alterative in enfeebled constitutions. By the Mahometan practitioners it is considered an antidote to vegetable poisons.

EKEBERGIA (Sprengel). A tree from the Cape of Good Hope, belonging to *Decandria Monogynia*, and to the natural order *Meliaceæ*. Generic character: calyx four-cleft; petals four; anthers sitting within an annular disc; style filiform, stigma headed; berry round, containing four seeds. This genus is placed in the class *Monadelphica* by Sprengel; is propagated by cuttings, and treated as a greenhouse plant.

ELÆAGNEÆ—the Oleaster family. A natural order of monochlamydeous dicotyledonous plants, containing five or six genera, and upwards of twenty known species. By its apetalous flowers, definite erect ovula, tubular inferior calyx, and leprous leaves, this order is at once distinguished from *Proteaceæ*, *Thymeleæ*, *Santalaceæ*, and *Combretaceæ*, to all of which it bears an affinity.

Its essential characters are: flowers diœcious, rarely perfect. In the sterile or male flowers, the calyx is four-parted; stamens three, four, or eight, sessile; anthers two-celled. In the fertile or female flowers, the calyx is inferior, tubular, persistent; the limb entire, or from two to four-toothed; ovary superior, simple, one-celled; ovule solitary, ascending, stalked; stigma simple, subulate, glandular; fruit crustaceous, enclosed within the calyx become succulent; seed erect; embryo straight, surrounded by a very thin fleshy albumen; radicle short, inferior; cotyledons fleshy.

The plants belonging to this order are hardy trees or shrubs, covered with minute silvery scales, having alternate or opposite entire leaves, and axillary, often fragrant flowers. They are found scattered over the whole northern hemisphere as far as the equator. A few inhabit China and Japan, and the remainder Europe, North America, Guiana, and the East Indies. They are not known south of the line. Many of them furnish edible fruits and astringent barks. The chief genera are, *Elæagnus*, *Hippophæ*, *Shepherdia*, and *Con*.

The genus *Elæagnus*, or oleaster, so named from its resemblance to the olive tree, furnishes several species, some of which are hardy, and cultivated in our gardens. *Elæagnus angustifolia* is a low tree with elegant silvery leaves and yellow flowers, which emit a strong scent, especially at night. *Elæagnus Orientalis* yields a large fruit, which is used in Persia as an article of dessert under the name of *Zinzeyd*. *Elæagnus arborea* and *conferta* also yield fruits which are eaten in Nepal.

Hippophæ rhamnoides, common sawallow thorn, or sea buckthorn, is found on sandhills and cliffs on the south-eastern coasts of England. It is a thorny shrub, four or five feet high, frequently cultivated in gardens on account of its silvery leaves. It bears a bright orange berry, which is sometimes preserved and eaten, more especially in Sweden and Tartary. It is used by the fishermen of the Gulf of Bothnia to impart a grateful flavour to fresh fish. The whole plant may be used to dye yellow.

ELÆIS (Jacquin), is a palm indigenous to South America, and from the fruit of which an oil is expressed; hence it is called the oily, or olive palm. It belongs to *Diœcia Hexandria*, and to the order *Palmae*.

ELÆOCARPÆ. A natural order of dicotyledonous plants, containing six or seven genera, and nearly twenty known species. It is very closely allied to *Tiliaceæ*, from which it differs only in its fringed petals and in its anthers opening by two pores at the apex. By some authors it is included under that family.

Its essential characters are: sepals four or five, without bracteas, and with a valvular æstivation; petals four or five, alternate with the sepals, lobed or fringed at the extremity; receptacle glandular; stamens from fifteen to twenty; filaments short and free; anthers long, four-sided, two-celled, opening by pores at the extremity; ovary many-celled, with two or more seeds in each cell; albumen fleshy; embryo erect, with flat leafy cotyledons.

The plants belonging to this order are trees or shrubs with alternate, simple leaves, and racemose flowers. They are natives of warm climates, and are found chiefly in the East Indies and in South America. Some are also met with in New Holland. Little is known in regard to their properties. The chief genera are, *Elæocarpus*, *Aceratium*, *Dicera*, and *Vallea*.

The species of *Elæocarpus* are in general handsome, and produce showy, fragrant flowers, which are succeeded by an edible fruit. The hard, furrowed stones contained in the pulpy fruit, are manufactured into necklaces in the East Indies. They are sometimes sold in our shops when set in gold.

ELÆODENDRUM (Jacquin). A genus of trees and shrubs found in the East Indies, New Holland, &c. Linnæan class and order, *Pentandria Monogynia*, and natural order *Celastrineæ*. Generic character: calyx minutely five-lobed; petals spreading, and broad at the base; stamens alternating with the petals, and fixed on a disk surrounding the germen; style very short; drupe sapless, from two to five-celled, with as many seeds, some of which are often abortive. This genus has been arranged with several other genera by different botanists, but now admitted as fixed by Jacquin. The hothouse species are pretty, and those from New Holland are kept in the greenhouse. They all strike freely from cut-

tings treated in the usual way. The trees are called olive wood.

ELAPHRIDÆ (Stephens). A division of the great Linnæan genus *Carabus*, comprising the genera *Notiophilus*, *Elaphrus*, *Blethisa*, and *Pelophila*. See **CARABIDÆ**. This group is distinguished by the unnotched anterior tibiæ, the antennæ are short and robust. From the *Cicindelidæ*, with which family they were arranged by Linnæus, they differ in their smaller size, and in wanting an articulated hook at the extremity of the lower jaws. They reside in damp situations, at the margins of streams, &c. The typical genus *Elaphrus* (Fabricius) may be distinguished by the elevated bosses upon the elytra, and by the rounded thorax. There are four or five British species, of which the *Cicindela riparia*, Linnæus, is the type; it is about a quarter of an inch long, and of a brassy greenish colour.

ELATE (Linnæus). A species of palm common in India. It belongs to *Monæcia Hexandria*, and to its own natural order. It has for a long period been one of our hothouse plants. It thrives best in sandy loam, and requires the warmest part of the stove.

ELATERIDÆ. A family of coleopterous insects belonging to the section *Pentamera*, and subsection *Serricornes*, forming with the family *Buprestidæ* (which see), a division under the name of *Sternoxi*, and distinguished by having the hinder point of the prosternum produced into a laterally compressed point, so as to be capable of being brought, at the will of the insect, into close contact with a depression in front of the metasternum, whereby, in consequence of the strong muscles with which these parts of the body are armed, the animal is enabled to effect a leap to a considerable height when laid upon its back, whence these insects have obtained the name of skip, or spring-jacks. The body is rather long and narrow, the mandibles notched at the tip, the palpi terminated by a joints larger than the preceding articulations, the joint of the tarsi are entire, and the posterior angles of the thorax are acute.

This is an extensive family of insects, but little diversified in their colours, whence they afford a strong contrast to those composing the other family *Buprestidæ*. The shortness of the legs renders essential some other apparatus, whereby the insects when laid upon their backs may recover their ordinary position. This apparatus is found in the peculiar structure of the parts of the breast noticed above and in the strength of the muscles with which it is furnished. In order to effect these motions the legs and antennæ are laid close to the body in grooves prepared for their reception; the head and thorax are bent backwards, until they reach the plane of position, and then the point of the prosternum being struck with force into the abovementioned cavity, causes a sudden jerk to be imparted to the insect, which has the effect of raising it to a considerable height in the air.

The habits of but few of these insects have been hitherto known. The females are furnished with a horny ovipositor at the extremity of the body, whereby they are enabled to convey their eggs to their destined situation in the midst of rotten wood, &c. De Geer has described one of their larvæ found in such a situation; it is of a scaly texture, and the tail is terminated by a margined flattened plate, of which the sides are notched, and the extremity cut out. The larva of *Elater striatus* devours the roots of wheat, and

occasionally commits considerable devastation. It is this state of the insect which is ordinarily known by the name of the wire-worm.

In the perfect state, the elateridæ are found upon flowers, leaves, and shrubs, and when they are alarmed they fold up their antennæ and legs, and fall to the ground.

Some of the South American species of the family forming the genus *Pyrophorus* (Illiger), are distinguished by the singular powers which they possess of emitting light from two yellowish patches on the sides of the thorax. Of these species, which are named by the natives *Cucuji*, the *Elater noctilucus* is best known, and so strong is the light which they emit, that two or three placed under a glass are sufficient to enable a person to see the time by a watch in the dark; and the females are said to fasten many of them to their dresses as glittering ornaments. According to Brown, all the internal parts of the insect are luminous, but there seems reason to doubt this statement. He likewise asserts that the insect has the power of suspending its luminosity at will. A specimen of this insect which had evidently been conveyed to France in American timber, in which it had undergone its transformations, caused much alarm to the inhabitants of the Faubourg Saint Antoine, in Paris, by flying about the houses, emitting at the same time its light. According to M. Lacordaire, who has observed the insect in its living state, the chief reservoir of this luminous matter is situated on the lower side of the body at the junction of the abdomen and thorax. See an interesting memoir by Mr. Curtis, in the Zoological Journal.

The generic distribution of these insects has, until lately, been but little attended to. Messrs. Latreille, Eschscholtz, and Stephens, have, however, latterly proposed numerous groups, founded upon structural characters, but in their natural history little has been noticed in support of the establishment of these divisions. There are nearly one hundred British species, of which the *Elater (Selatosomus) æneus*, distinguished by its fine metallic tints, the *Elater (Corymbites) pectinicornis*, having branched antennæ, and the *Elater (Ludius) ferrugineus*, being the largest British species, are the most conspicuous.

ELATERIUM (Linnæus). A genus of climbing West Indian annuals, bearing large fruit of the gourd kind, and for which they are cultivated there.

ELATINE (Linnæus). An aquatic annual genus, containing two or three species, natives of Europe. Two of the species are English plant, and known by the name of water-pepper, or water-wort.

ELATINÆ—the Water-pepper family. A natural order of dicotyledonous plants, containing only a few genera and species. By many authors this order is looked upon as a section of *Caryophylleæ*, from which, however, it is distinguished by its capitate stigmata, by the dehiscence of its fruit, and the want of albumen. It bears a considerable affinity to *Hypericineæ*, but differs in having a persistent central axis in the fruit and definite stamens.

Its essential botanical characters are: sepals three to five, persistent; petals three to five, alternate with the sepals; stamens hypogynous, usually twice as many as the petals; ovary with from three to five hypogynous cells, the same number of styles, and small, capitate stigmas; capsule three to five-celled, and three to five-valved; valves separating from the dissepiments which alternate with them; seeds nume-

rous, with a straight embryo, whose radicle is turned towards the hilum ; no albumen.

The plants belonging to this order are herbaceous annuals with hollow stems, and opposite, exstipulate leaves. They are found in marshy places in all quarters of the globe. Their properties are not well known. The chief genera of the order are *Elatine*, *Bergia*, *Merimea*, and *Crypta*. The species of the genus *Elatine*, or water-wort, are natives of Europe, and two of them are indigenous in Britain. The *Bergias* are found at the Cape of Good Hope, and in the East Indies, while *Merimea* is confined to South America.

ELDER is the *Sambucus nigra* of Linnæus, a very common plant everywhere. It belongs to the first class of Linnæus, and to the natural order *Caprifoliaceæ*. The wood of this small tree has a very large pith when young, but smaller in old stems, and then the wood is remarkably hard and durable. Water distilled from the flowers is used as a cosmetic, and a kind of wine is made from the ripe berries. There are six varieties in gardens, all of which are increased by cuttings.

ELECAMPANE, is the *Corvisartia helenium* of Merat, formerly the *Inula helenium* of Linnæus. This genus of plants is chiefly European ; several of them natives of Britain. They are mostly perennials, bearing yellow flowers, and belong to the order *Compositæ*.

ELEPHANT (*Elephas*). A genus of *Pachydermatous* or thick-skinned mammalia, belonging to that division of the order to which Cuvier gives the name of *Proboscidea*, or animals which have the nose or upper lip elongated, and forming a trunk or proboscis, or other prehensile instrument.

The elephant has but few characters in common with the rest of the order *Pachydermata* ; and indeed that order is among the most perplexing in all the mammalia, because the mere thickness of the skin is not a good ground of classification. Thus it is impossible to give, under the title of the order, any general account of all the genera ; and therefore it becomes necessary to enter a little more into detail of the characters of each genus.

There is perhaps no animal respecting which less apology is necessary in this respect than the elephant. In point of size and strength, it stands foremost in the whole class of land animals ; and though its sagacity and docility have been greatly overrated, it is to a considerable extent tractable, and in so far a sagacious animal. We use these words in an animal sense of course, and not with any reference to docility and sagacity as predicated of human beings ; and we may mention that the boasted sagacity of the elephant is vastly inferior to that of many varieties of the dog.

Still the elephant is highly interesting in very many points of view. It has been connected with the power and state of eastern nations from very early times ; and before the invention of fire-arms, the elephant was regarded as a very powerful auxiliary in war, and numbers of them were brought into battle, not only in Asia ; but in some parts of eastern Europe. Even now the elephant is a useful appendage to an Indian army ; but it is chiefly as a beast of burden, in the transportation of artillery, and of baggage which is too heavy for the more ordinary carrying animals. He is also used as an appendage of state, for which purpose himself and the *hondah* or *crib*, which is fastened on his back, are both decked out in the most gorgeous manner. But though the elephant

has thus been made the servant of man for many purposes, almost from time immemorial, it has never been tamed or domesticated in the proper sense of the word. Elephants have never lived in what may be called companionship with society, and under the protection of man, as has been the case with the dog, the horse, and many other animals. There are a few rare instances recorded in which elephants have bred in a state of confinement, but those instances form the exception—the rare exception, and not the rule ; and on account of them we cannot venture to say that the elephant has ever been a domestic animal.

There is another point of view in which the elephant is of great interest, especially to those who study the history of nature in its connection, both of place and of time. Of living elephants there are only two species, the Asiatic and the African, though there are several varieties, apparently climatal, of the former one. Of these there is not a vestige in any other part of the world than those in which they are at present found, unless it be the accidental bones of one which has been brought from its native country for the purpose of exhibition, and which, perishing before the establishment of museums in which the bones of strange animals are industriously collected, had been buried by the way side. There are some rather ludicrous instances of the bones of such elephants being dug up, after the appearance of the animal at the place had been forgotten, and gravely considered as the bones of antediluvian or other giants of the human race. The countries in which only the two existing species of elephant are found, all have the tropical character ; and as there is no evidence of the animal being naturally out of them, we must conclude that both are adapted to the forests and marshes of those countries, and to them only.

There is, however, a third species of elephant, of which there is no living specimen, though the remains of it are abundant. Those remains are found in very great numbers in the northern parts of Asia, and especially near the shores of the Polar Sea in that quarter of the world ; but they are not found to the northward of the Lake of Aral, so that the central plains of Asia do not appear ever to have been an elephant's country ; but if we suppose, as is most probable, that the two races were co-existent at some former period, we must suppose that that country, which is in all probability the native one of the horse and the wild ass, formed a sort of natural boundary between the pastures of the southern elephant of Asia and the northern one.

In Europe the remains of this elephant are not so numerous as they are in Asia ; but as is the case there, they are confined to the northern parts ; and we are not aware that any vestige of them has been found to the southward of that parallel which forms their southern limit in Asia, and which answers to nearly about the middle of France. There are some few of those remains in Britain, though they are not so numerous there as in some places of the continent. This elephant was not, like the two which are natives of tropical countries, confined to the eastern continent, for the bones have been met with in America, though not in any place further to the southward than about the parallel of the south of Spain, which, if we take the two continents according to the average of their present temperature, will answer to about the same limit in point of heat as that which marks the southern boundary of those animals in the eastern

continent. We mention these few particulars in the meantime to show that the elephant has a longer and more interesting tale to tell, than is to be found in all the anecdotes which are repeated of it as a living animal, and which even though we discount the exaggerations and the misrepresentations respecting qualities which the animal does not and cannot possess, but still is not entirely divested of interest,—passing over these in a great measure, we shall first give some account of the appearance and characters of the living elephant, without any distinctions as to species, and then very briefly point out how the Asiatic and the African differ from each other, and how the northern or fossil elephant differs from both.

Generally speaking, the skin of the elephant is of a dusky black, with only a few hairs scattered over the general surface; but on the top of the head the hairs are much closer, and about the same length as hogs' bristles, to which indeed they bear no inconsiderable resemblance. A very imperfect notion of the appearance and texture of the skin of the elephant is obtained from examining the specimens which are shut up in menageries in this country, even in those places where they are treated with the greatest kindness and care. Their skin is invariably callous, and often apparently chapped or cracked into pieces, which have little or no sensibility. But when the animal is in good health and in its proper climate, and at its freedom, the skin is smooth and soft, and is probably almost as sensitive to the bite, even of a small insect, as the thinnest skin that can be imagined. When the animal is in this condition, there is indeed a wonderful power in the muscles of the skin, so that by the agitation of that alone an elephant is often capable of shaking off a wild beast. There is another difference of appearance between the elephant of the European shores and the elephant in its native forests, which it is necessary to attend to for the purpose of not being misled. The confined elephant has the skin loose and wrinkled, and apparently too big for it, whereas in a state of nature the skin is comparatively tight, and there is considerable plumpness in the appearance of the animal. It is probable that this difference, by means of which the confined elephant shows to so little advantage, is owing to the action of the colder climate on the skin; and this is another proof that the skin of the elephant possesses a good deal of sensibility when the animal is in proper health. This is indeed the case with the greater number of the *Pachydermata*, which really have the skin more sensitive than many of the thin-skinned animals; and thus, in so far as they are concerned, the usual associating of the epithet "thick-skinned" with the fact of want of feeling is incorrect.

The head of the elephant appears rather small in proportion to the size of the animal, but the form of the outline (in the Asiatic elephant particularly, which has the front-line nearly straight,) gives it an expression of intelligence. The eye adds considerably to this expression; for though very small in proportion to the size of the animal, it is bright and expressive. The ears are large and pendulous, though smaller in the Asiatic than in the African. The body is thick in proportion to its length and considerably arched in the line of the back, which gives the animal great strength in carrying. The legs are also very stout and massy. The feet are not divided into toes externally visible; but there are five short flat nails on each of the fore-feet, and four on each of the hind

ones. The feet and legs, though apparently stiff and awkward, are not so in reality. The fore-foot can be used with considerable adroitness as a sort of hand, in conjunction with the trunk, and both feet are used in stamping the enemies of the animal to death. The tail is slender and nearly naked for the greater part of its length; but it has a thick brush at the point, which, in the healthy animal, reaches nearly to the ground.

In size, elephants differ considerably; but when full grown they are rarely less than seven feet in height at the shoulders, or more than twelve. When they are below seven feet they are not considered fit for hard service, and none are purchased for the use of the British army in India, which do not stand this measure. The females, which are the most docile, are very seldom above eight feet; but the males are often considerably more. The following are the dimensions of a male measured in India, which was considered to have attained its utmost growth: from the line of the forehead to the insertion of the tail, fifteen feet eleven inches; perpendicular height at the shoulder, ten feet and a half; measure across the shoulders from the ground on the one side to the same on the other, twenty-two feet two inches and a half; and height of the crown of the head from the ground, set up as it is when the animal marches in state, twelve feet two inches. As the proportions of these measures to each other may be considered as pretty constant in adult elephants of all sizes, they will serve to give a general notion of the form of the animal.

The most singular organ in the elephant, and the one which most distinguishes it from all other living animals, is the proboscis or trunk, which, though one would not be apt to believe so from seeing it in a state of repose, is probably, the human hand only excepted, the most curious mechanical instrument in the whole animal kingdom. This proboscis is an extension of the snout of the animal, of a tapering or subconical form, and sometimes as much as eight feet in length. The two perforations in it, which answer the purpose of nostrils, can draw in water, or spout it to a considerable distance; and as the elephant cannot drink directly with the mouth, unless when immersed in water as far as the opening, the trunk answers the purpose of a drinking horn, as the animal can suck it full, and then, elevating the head and the basal part, and recurving the extremity downwards and inwards, blow the whole contents into the mouth. The extremity of the proboscis is on the upper side formed into a sort of rounded lip, which bears some analogy to the fingers of a hand, while the underside terminates in a single elongated tubercle, which has the same analogy to a thumb. The body of the trunk is made up of an immense number of muscles with their tendons, amounting in all to not less than four thousand, which is considerably greater than the number in the whole human body. Those muscles have their insertions in the external and internal coverings of the trunk; and they lie in a great variety of directions, some longitudinal, some nearly circular, and some oblique. The variety of motions which may result from the union of so many moving forces, so differently placed with regard to each other, and of which we may suppose any number, from one to the whole, capable of moving at one time, is far greater than any ordinary arithmetic can sum up. The most powerful motion of the trunk is

that of the under side ; and when it curls round, which it sometimes does so as to form two hands, one by the curling fold, and one by the lip and tubercle at the end, the curl is always downwards, though it can complete a ring of the curl someway up the trunk, and leave a portion of the extremity free, by which means the prehensile part at the extremity can act upon what is held in the fold. The oblique muscles enable the trunk to be twisted, so as to place the loop of the fold longitudinally ; and with the trunk placed this way an elephant will hold a bottle and extract a cork with the greatest neatness. The oblique muscles also act in elongating and shortening the trunk, in a manner similar to that in which many of the *Annelidæ*, or ringed animals can elongate and shorten their whole bodies. The trunk itself, from the great number of its muscles, is a very powerful instrument, and by means of it the animal can tear down a strong branch of a tree, lift a considerable weight, or hit a very severe blow. Upon examining the head of an elephant either in front or in profile, it will be seen that the insertion of the trunk is peculiarly strong. The bones of the lower part of the face are massy and strongly arched ; the neck is nearly of the same thickness as the head, and the muscles by which it is connected to the body are very powerful. The elephant does not butt with this powerful part of the head, as is done by various ruminating animals ; but it can push along a very heavy weight, or break through a strong paling, by the dead pressure of its snout. Where tame elephants are used, this property is often turned to considerable account ; and those elephants which are in the service of the Indian merchants, may often be seen doing the work of a dozen of porters, in pushing about bales and boxes, and rolling heavy casks. In the wild state the trunk answers many important services. With it he gathers his food and puts it into his mouth, draws up water to quench his thirst, or to sprinkle his body, and collects dust, which he throws over his skin to disperse the mosquitoes and flies that annoy him. On all occasions he is most careful of his trunk, and unless when tied and picketed, he seldom uses it as a means of offence. The males use their tusks for this purpose, and the females endeavour, by falling upon the tiger, to crush him by their weight. The fact is that though elephants are exceedingly peaceable animals in their native haunts, unless when they are annoyed, or in the rutting season of the males, at which time they are in a state of excitement bordering upon fury, and are formidable to tigers and all other beasts of prey, and even to the rhinoceros himself, which, though perhaps a stronger animal in proportion to his size than the elephant, is not so susceptible of violent passions or so active in his motions.

Next to the trunk the most remarkable external character of the elephant is the tusks. These occupy the place of the ordinary canine teeth of animals, or rather perhaps that of the two great incisive teeth in the upper jaw, which belong to several of the rodent or gnawing animals, and to some of which the real teeth of the elephant bear a considerable resemblance, at least in the substances of which they are composed. The teeth, or rather tusks of the elephant, are not inserted by simple roots into the jaw or nasal bones, they are for a considerable part of their length toward the root hollow, and inserted on a conical core which perhaps gives them a firmer rooting than if they were placed in sockets. These teeth form the well known

substance, the ivory of commerce, and they often attain a very large size in the old males, the quantity of ivory in a single pair being sometimes at least one hundred and fifty pounds weight.

In the living elephants of both varieties, the tusks are either nearly straight, or curved upwards, or if their direction be nearly that of the line of the face they are inclined forward at the points. In the fossil elephant, on the other hand (at least in all the specimens which have been found), the curvature of the tusks is the other way, or downwards. What may be the use of this difference of structure it is not easy to say, because we know nothing of the habits of the extinct elephant, and very little of what the state of the country may have been when it was alive ; but, as the tusks in it are so constructed as that they might act as hooks in pulling down substances higher than itself, and as it is probable that the northern marshes were at that time covered with tree ferns, and those other palm-like plants, of which the remains are abundant in the fossil state, though not a vestige of the same plants now appears on the surface of the same regions, we may, perhaps, venture to conclude, that those tusks had been employed in pulling down the fronds of those plants, in order that the animals might feed upon them.

The tusks of the elephant are two in number, and they vary much with the age and sex of the individual, and there appear to be also permanent varieties of this kind, the cause of which is not known. In the females they are generally much smaller than in the males ; and it is not till the female has attained the age of several years, that they project beyond the mouth. In India, where elephants are most used, and therefore more attended to than any other part of the world, there are several distinctions made from the size and shape of those extremities. The perfect elephant, called *pulley dant*, has the tusks projecting forwards and upwards. Those called *dauntelah*, or elephants with large teeth, vary from the projecting horizontal, to the nearly straight tusks of the mooknah, which point directly downwards. Between these two there is a great variety in the form of the tusks. The largest teeth found in the male elephant, are from five to eight feet in length, and from four to eight inches in diameter, and weigh from twenty to eighty pounds each tooth. In the mode of their growth, though not in their substance, their tusks bear a much nearer resemblance to the hollow horns of the ruminantia ; and, indeed, from the vast quantity of animal matter, and the comparatively small portion of salts of lime, ivory approaches, perhaps, as near to horn as it does to bone, and more so than to enamel, of which the tusks of the elephant contain little or none. In their very young state, elephants have milk tusks, which have very little adherence to the bones of the head : those drop off when the animal is about fourteen or fifteen months old, and soon after the permanent tusks make their appearance, and are not shed while the animal lives. They continue growing by a new layer of ivory on the inner surface, which is secreted by the pulpy substance on the core filling the hollow, just as is the case with the horn of an ox ; and as each of these new layers is a complete cone of ivory, extending to the very point of the core, the solid part of the tusk increases in length, in proportion to the general growth of the whole.

There are no cutting teeth in the lower jaw of the

elephant, or indeed any other teeth answering to the tusks of the upper jaw. The rest of the teeth have their crowns, generally speaking flat, but from the way in which they are constructed, they are well adapted for cutting and bruising those hard substances upon which elephants are at times obliged to feed. Those teeth which are the only useful ones to the animals, in preparing their food for the stomach, may be compared to a set of irregular chisels placed across the jaw, and supported in the intervals by a substance much softer, and bearing some resemblance to the ivory of the tusks, though probably not so hard, and containing more animal matter. The protuberant ridges, which we have said resemble irregular chisels, are formed of the hardened enamel; and though, from the quantity of food which so large an animal requires, they are subject to wear, they are always higher than the intervening substance by which they are supported; and it is probable, also, that this substance, being in so far elastic, gives way a little when the food requires a powerful bite.

In the Asiatic elephant, which is the only one of which the progress has been accurately observed, the first grinders, or milk-teeth as they are called, begin to cut the surface as early as nine or ten days after the birth. Those grinders consist of four laminae, or ridges of enamel; but they are altogether of soft texture, so that they soon wear away. They are not shed, as is the case with the milk-teeth of some other mammalia, and with the milk-tusks of the elephant itself; but are worn away gradually while the second set are coming forward; and by the time that these are full grown, which is the end of about the second year, the body of the first ones is completely worn away, the roots are absorbed, and every vestige of the teeth is obliterated. The second teeth contain eight or nine laminae, or about double the number in the first, and the jaws lengthen proportionately to give them room. When the second set are perfected, and have to perform the whole labour of mastication, by which they are to be in time worn away, the third immediately begin to form in the rear of them; and they continue growing from the end of the second to the end of the fifth year, by which time the second teeth are nearly exhausted, and the third occupy their place. These third ones have twelve or thirteen laminae, and are consequently much longer, that is, they occupy a greater length of the jaw than their predecessors; and the jaw itself of course lengthens in proportion. The third set lasts from the beginning of the sixth year to the end of the ninth, at the last of which periods it gives place to the fourth set, on which the number of laminae to each tooth is fifteen or sixteen. This process goes on during the life of the animal, every succeeding set of teeth consisting of a greater number of laminae, occupying a greater length of the jaw, and requiring at least a year longer than its predecessor to bring it to maturity.

We have been thus particular in describing the mode of dentition in the elephant, because there is nothing like it in the whole animal kingdom; and as it evinces a power of reproduction without end in the teeth which those animals use in feeding, it may be considered as an indication of great longevity; the more so, that the teeth of most animals are the parts of them which are apt to suffer the earliest decay. There is something slightly analogous to this in the cutting teeth of some of the rodent animals, especially in those which have to gnaw bark and other hard

substances for their food; and these are the teeth which in their substance most resemble the teeth of the elephant. Those teeth in the rodent animals are, however, simply cutting teeth, and not used in bruising or grinding their food; they are therefore simple chisels, with a layer of enamel on the front side, and the supporting substance, which is not unlike ivory, placed behind, and so much lower on the gum as to allow the cutting edge of the enamel to act. Those teeth grow for life, as well as the teeth of the elephant; but they do this, not by any replacement of the old tooth by a new one, but by the growth of the same individual teeth at the roots, as they are worn away at the points. Thus the analogy between them is comparatively a very slight one; and the elephant must still be allowed to be the only possessor of that singular reproduction of the teeth, by which it is distinguished from every other known animal.

But though this reproduction of the teeth is, in itself, a very decided proof that elephants are long-lived animals, it furnishes us with no data whereby we are able to ascertain the exact age to which they live. Nor have we sufficient knowledge of elephants in a state of nature for enabling us to get at the fact by observation, as elephants in this state are not often seen, except when they are to be captured for servitude, or hunted for the sake of their tusks, the last of which, probably, conduces the most to their extermination. There are recorded instances, however, of elephants living to the age of one hundred and fifty years in a state of servitude; and if we add half to that period, or even double it, we shall not perhaps over-rate their duration in a state of freedom.

It is probable that the decay of elephants in old age arises from the stiffening of the joints; for four or five tons constantly borne, is a heavy pressure on the working structure of an animal. This stiffening of the joints in advanced age may also, in part, have given rise to the old fabulous belief, that elephants are incapable of bending their legs, so as to lie down, or even to kneel, for the purpose of repose. In the case of young elephants this is not true, for they lie down to sleep in the same way as other animals, though probably not quite so often. When they are old they are said not to lie down often, even for the purpose of sleeping; and instances are mentioned of elephants in India, subjected to labour, which did not lie down for twelve months or more, though, they occasionally slept a little on their feet. The wild ones are said to take their occasional repose leaning against the bole of a tree. In confinement in this country, we believe, they take their repose leaning against the sides of their dens; but an elephant in a den, and exposed to the climate of this country, is so much out of its natural element, that no conclusion drawn from observing it will apply to the race in a state of nature.

The voice of the elephant, as usually heard in a state of confinement, is almost as hollow as the roar of a lion, though it wants the peculiarly offensive roughness of the lion's voice, which grates so harshly upon the ear, and puts one in mind of the rending and mangling of the flesh of animals. But this disagreeably hollow sound is not the only one uttered by the elephant, or even the most common one, where the animal is free and at its ease. The elephant has three voices: one which is shrill, but ends in a murmur, as if the animal were coaxing; one which is deep, but soft and complaining; and one,

which is the harsh and hollow roar, which is most frequently heard from the confined animal. The first of these is sportive, and, so long as the animal utters it, there is nothing to be feared. The second is complaint, and, if the cause of it be found out and removed, it will give place to the first, and there is still no danger; but the third is indignation or revenge, or both united, and then it is not safe to come near the animal.

From the character of their teeth, the only teeth which they use in the preparation of their food, it is needless to say that elephants feed only upon vegetable substances. As is very generally the case with vegetable feeders, they prefer succulent matters, and especially such as are sweet, or have otherwise an agreeable flavour. In their native forests it is possible that they do not meet with much food of this kind, but subsist chiefly upon the coarse grasses in the openings of the forests, and the leaves and young branches of shrubs and trees. They are social and gregarious animals; and the herds in which they assemble depend, of course, upon the extent and richness of their forest. The old and young ones associate together without the slightest animosity; and though it is not ascertained that the numbers of the two sexes are equal, or that they live in pairs, yet they are almost invariably led on by the eldest male and the eldest female, which move in advance, and the others appear implicitly to follow their motions. In India elephants are most abundant in the thick woods on the left bank of the Ganges, along the Brahmapootra, and in the forests of Chittagong, farther to the east. The places of Bengal, in the immediate neighbourhood of the forests on the Ganges, are exceedingly rich, and well adapted for all the more valuable products of the Indian soil; and, therefore, in them cultivation is carried closer to the forests than in the less fertile parts of the country. The consequence is, that elephants, though perhaps not so numerous there [as in Chittagong], are much more frequently seen. The herds also occasionally invade the cultivated fields, eating vast quantities of green sugar-canes, rice, bananas, and other crops, and trampling down and destroying the remainder with their great feet. They are also very bold and very formidable in their invasions; and unless the people can rise *en masse*, and drive them off with torches and cannon shot, they must just look on, and behold the ruin of their fields, until it shall please the elephants to retire.

The keeping of an elephant is a very expensive matter, the quantity of food required being from one hundred to one hundred and fifty pounds' weight every day. This is, however, the quantity estimated for a full-grown elephant in perfect health; and the small and sickly ones, which are generally in this country, do not require so much food. Chuneé, whose death, or perhaps murder, in the menagerie at Exeter Change, some years ago, excited so much of the public attention, was a sturdy fellow in this way; and though he had been cooped up in menageries, and been made to play on the boards of national theatres, kept his health well, and grew apace till he reached the weight of nearly four tons. No inquest was held upon him, but it was whispered among zoologists that Chuneé's fury was not the sole cause of his death. The two supplemental ones which were mentioned were, first, that as the place was to be taken down and the animals removed, the removal of Chuneé would have

been a matter of great expense and labour, and not altogether free from danger, either to himself or to those about him; and, secondly, that Chuneé required so much food, and people had become so familiarised to the sight of him, that he had become a losing speculation. We know not what truth there may be in these surmises, or whether there may be any truth in them at all, though we mention them as connected with one of the largest and most vigorous elephants that ever was exhibited in this country. True or false, no blame whatever can by possibility attach to the owner. The animal was property lawfully purchased; and we know of no law to prevent a man from killing his own elephant, any more than for killing his own mutton.

As we hinted in a previous part of this article, the old prejudice that elephants scorn to breed in a state of confinement, is totally without foundation. From the great excitement of the males during the rutting time, it is natural to suppose that when they are in confinement, or poorly fed, or severely worked, their system will not be stimulated to the requisite degree; and, therefore, the young elephants which are born in confinement are exceedingly few; and no instance of it has occurred in modern Europe. From some accounts given both by Ælian and Columella, it should seem that in the time of the Romans, when elephants were kept by them for the purposes of ostentation or of war, there were at least a few of young produced in confinement. But the most decisive evidence that we have of this point is from Mr. Corse Scott, who from his residence at Tipperah, in the eastern part of Bengal, had excellent opportunities of studying the natural history of elephants, and who improved those opportunities to admiration. Mr. Scott had an elephant born on his own premises, both parents of which were in his possession for some time previous to the commencement of the gestation. By this means Mr. Scott established, for the first time, we believe, an important fact in the economy of these animals, namely, the exact length of time that the female goes with young. This had been previously mentioned by writers on the natural history of the elephant, but apparently from hearsay; but Mr. Scott ascertained it to be from the first of July, 1793, to within a day or two of the first of April, 1795, which may be considered as exactly twenty months; and from all the rest of his observations he had no reason to conclude that the period is ever different from this. Both of Mr. Scott's elephants were above the standard required by the army in India; but the female was not old, for during the period of her gestation she increased five inches in height.

The young elephant at its birth stands about three feet high, and it grows nearly a foot more the first year, two-thirds of a foot the second, half a foot the third, five inches the fourth, rather less in the fifth, between three and four inches in the sixth, and two and a half in the seventh. Thus, there is a yearly diminution in the quantity grown; and it is probable that ultimately this growth ceases, though there is every reason to believe that the oldest elephants of both sexes are the largest.

The young begins very early to suck; and while it performs this operation with the mouth, it at the same time presses the teat with the trunk to aid the flow of the milk. In a state of nature, the female elephant appears to have very little attachment to her young, less so than most animals; for it is stated that when a female

with her young one is captured, two or three days' absence will make her entirely forget it—though the young one itself recognises her, and utters the most plaintive cries for the purpose of attracting her attention. This fact, which appears to be well authenticated, is pretty strong evidence against the sagacity, affection, and other half-reasoning qualities which fiction has attributed to the elephant.

As the pastures of the elephant are perennial pastures which feel no season of want—and, indeed, such pastures only are adapted to animals requiring so much food, elephants have no rutting season, common or nearly common to the whole herd, for young ones are found at all stages of their growth at almost every season of the year. The length of time during which the female elephant suckles her young one, has not been accurately ascertained; and, indeed, from the indifference to it which we have mentioned that she shows, it is highly probable that the period varies much according to circumstances. There seems to be a natural provision for this in the early appearance of the milk teeth in young elephants, which, though small in the first instance, appear to be capable of masticating the softer vegetables when the animal is only a few weeks old: this may be a necessary provision in the economy of elephants, because at certain seasons the female may have to range farther and faster for food than her young one is able to follow her, while the place which she leaves may still afford a supply sufficient for the support of her deserted offspring.

Notwithstanding the great size and strength of the elephant, the fury which he evinces when excited, and the perfect safety in which he lives in forests which contain the most bold and ferocious beasts of prey, and the most formidable reptiles, he is no match for man, in even the lowest degree of civilisation. The rude man has only to kindle a fire, and the elephant flies in the utmost consternation; or he digs a pit, and conceals it with green boughs; the elephant falls into it, and his very weight and strength are the means of his destruction. The elephant is to all appearance safe from the paw of the tiger, the jaws of the alligator, the crushing folds of the python, and the poison of the most deadly serpent; but he has no defence against the wiles of man. The countries which he inhabits contain, amid the luxuriance with which they are adorned, vegetable poisons of the most mortal character. The rude man has found out by experience how to concentrate these, till they shall speedily curdle the blood, or benumb the frame even of the elephant. So he dips his weapon in the deadly virus, bends his simple bow, sets his arrow on the string, takes his aim with certainty, and in brief space the giant volume of the elephant tumbles lifeless on the earth.

The animal senses of the elephant appear to be all very acute; while he is in health the whole of the skin is sensitive to very trifling causes; and the top of the proboscis has probably as keen a sense as the points of the human fingers. His eye, also, is keen, though the range of his vision is probably not very extensive. Indeed, sight is not the most useful sense in such places as those which the elephant inhabits; and the senses of animals are in general adapted to the nature of their haunts. The sense of hearing is a much more serviceable one, among tall vegetation, than that of sight; and from the size of the elephant's ears, and the freedom with which he can move them

backwards and forwards, there is reason to conclude that, in him, this sense is very acute. That the sense of taste is far more keen than in many animals that feed upon vegetables, is proved by the fact of the elephant being so partial to sweet or racy vegetables, and even to sweetmeats. The sense of smell appears, however, to be the leading one, both in enabling the elephant to find that which he seeks, and to avoid that which it is his instinct to shun. Some naturalists have said that the proboscis does not possess this sense, but the saying appears to be a mistake. Every animal which has a perforated nose, whether that nose be long or short, uses it as an organ of smelling; and no good cause can be shown why the elephant should be an exception to the general rule. From the other functions which this organ performs, it must be very copiously supplied with nerves; and we have direct evidence that the elephant chooses or rejects those articles which are offered to him by means of his proboscis; nor is there any instance mentioned of his having ever attempted to distinguish scent by means of any other part of his body. But the elephant hunters know full well how necessary it is to give the elephant the wind, or approach him on the lee-side only; for if they attempt to come upon him from the windward, he is either off, or so excited and prepared, that he becomes the hunter, and they the hunted.

The intelligence usually attributed to the elephant is a different matter. We cannot say positively that the intelligence of any animal is in the ratio of the volume of its brain as compared with that of the whole body, because the functions of the brain are of too obscure and delicate a nature for being made the foundation of absolute demonstration. Still the degree of animal sagacity, leaving intellect altogether out of the question, bears some relation to the volume of the brain, although we are not able to say that they follow the same numerical proportion, or even to state the law in a numerical series of any kind.

That there should be an increase of the one with an increase of the other, is in perfect accordance with the general analogy of nature, which runs through the whole system of animal life, and forms no small part of the beauty of that system. The power, especially the mechanical power, of a particular organ, such as the clutching of a paw or the turning of a proboscis, is a local matter, and may depend on the extent to which that particular organ is furnished with the energy of life; and ganglions and local nerves may accomplish this in the largest of the mammalia, as well as in the most minute of the insect tribe. But that which we call sagacity does not depend on any thing local, it belongs to the whole system; and, therefore, if we are to refer it anywhere, we might refer it to the brain, or the central mass of the nervous system; at least, if we do not this, we must abandon all analogy, and set at nought the results of all observation; well, if we compare the brain in man with the whole mass of the body (and the human brain can be no more mental, at the same time that it is more material, than the brain of any other animals); and if we make the same comparison in the elephant, we find that in man, when not overloaded with fat (which is not understood to be particularly favourable to sagacity), the volume of the brain is to that of the whole body in the ratio of about 1 to 212. But if we make the same practical comparison in the elephant, we find the brain to the body in the ratio of only about 1 to 500, thus forming a very small

part of what it proportionally is in man. In as far as the analogy of nature is concerned, what has been now stated appears to be conclusive against any high degree of sagacity in the elephant, even as compared with other animals. It is certainly inferior to the dog, and probably also to the pig, an animal which we are not in the habit of rating very high in the scale of intelligence. But the pig may be taught as many tricks as the elephant, though it wants some of the mechanical apparatus for the performance of them; and a pig has been trained to stand and point at game, which no elephant ever did, even under the immediate guidance of its mahaut, with the conducting iron stuck in the top of its head.

Whence, then, could have arisen the very general belief in the sagacity of the elephant; and why have the Hindûs given it a place in their temples as the god, or, at all events, the emblem, of wisdom? The second of these questions, probably, involves in it the answer to the first. The Hindûs are not very particular in the choice of their gods; and a people who can believe that there is certain salvation in the possession, or the mere vicinity, of a fossil shell (the *Salgram stone*, which is simply a *Cornu Ammonis*), or that cow dung is the most sacred of all substances, cannot be expected to be very skilful or accurate in their choice of the god or any emblem of wisdom. Among the ignorant, what is considered as a wise look (though proverbially a sign of folly among the better informed) is generally held to be the certain indication of absolute wisdom. An owl is among the most stupid of birds, which, taken altogether, are a stupid race as compared with the mammalia; and yet the owl was the symbol of wisdom among the most polished, and, on some points, the most philosophical people of ancient times. We have not made these few remarks with any view to the disparagement of the elephant, but only to correct the vulgar prejudice respecting it, and to elevate it to its true and proper place in the animal kingdom, by doing what we can to reduce the accounts of them within the bounds of sober truth and real usefulness.

When noticing the principal haunts of elephants in the wild state, we omitted to mention, that though they are found in places which have always too much moisture to prevent their being burnt up, and are seldom far from the water, and very often swimming and bathing in it with apparent pleasure; yet they always prefer the clear waters, which have their banks comparatively firm. They sometimes spout muddy water over their bodies with their trunks; but they do not wallow in the mud, or walk upon the surfaces of deep and sludgy quagmires. Their weight and the form of their feet are both ill adapted for such places, and they would sink into them beyond the power of extrication. Neither are their feet suited to rough and stony paths, nor even to those which are very much indurated, as the soles of them are apt to get bruised, and thus the feet of an elephant are the first parts that fail on a long march. Elephants also move but slowly up a hill, evidently on account of their great weight, and although the same weight accelerates their motion down hill, they are very much shaken and jaded by resisting the downward impulse. Their place of best, or at all events of longest continued motion, is upon level ground.

Such is a summary of the greater part of what is known of the elephant, in a state of nature; and it

relates wholly, or chiefly, to the Asiatic species, for the African one is hardly known, except as a hunted animal, for his tusks, his flesh, or both—an elephant being a feast of many days to the inhabitants of an African village.

But from the length of time that the elephant has been pressed into the service of man, for purposes of ostentation, or for labour, makes him interesting as connected with human history. Our notice of him in this way must be very brief, but it would be incomplete if we did not prepare it by a short account of the manner in which elephants are captured. This we shall take in substance, but in a very abridged form, from the account given by Mr. Corse Scott, and first published in the *Asiatic Researches*. We shall do this because it is the production of a man of practice, as well as intelligence, drawn up from his own experience as a regular elephant catcher, at a time when these animals were in much demand in India.

We may observe, that the country from the Ganges and Brahmapootra eastward to the Mug mountains, and from Chittagong, on the bay of Bengal, northward to the mountains of Assam, is remarkable for the humidity of its climate, and the luxuriance of its vegetation, both in forest trees and in shrubs and herbaceous plants. It lies in the line of both monsoons: and thus its dry season is very short, as compared with that of India generally. Some of the lower parts are swampy and unhealthy; but a considerable extent consists of gentle slopes of firm ground, covered by rich forests and under growth, and in every respect a chosen country for elephants.

In this country the herd of elephants is taken wholesale, by being driven into a series of inclosures called *keddah*. This in general consists of three inclosures, formed of very strong stockades on the outside of deep ditches; the third, or innermost inclosure, being usually the strongest of the three. It requires to be elephant proof, because, when the animals get as far as it, they are generally in a state of great excitement.

Previous to the hunt, some of the most intelligent of the natives, who are conversant with the woods, and experienced in discovering the elephants without alarming them, are sent out to find the herd, and to note particularly the direction in which it is ranging; for as elephants clear the pasture before them, almost as completely as reapers, they range on a course for the distance of many miles. When they are discovered, the *keddah* is constructed at a considerable distance in front of them, but in the line of their advance; and all things being thus ready they proceed to the capture, which is a matter requiring great skill and attention, and by no means unattended with danger. When a herd is discovered, about three hundred people are employed to surround it, who divide themselves into small parties, consisting generally of three men, each at the distance of about twenty or thirty yards from the other, and form an irregular circle, in which the elephants are inclosed; each party lights a fire, and clears a foot-path to the station that is next him, by which a regular communication is soon formed through the whole circumference from one to the other. By this path reinforcements can immediately be brought to any place where an alarm is given: and it is also necessary for the superintendents, who are always going round, to see that the people are alert upon their posts. The

first circle being thus formed, the remaining part of the day and night is spent in keeping watch by turns, or in cooking for themselves and companions. Early next morning, one man is detached from each station, to form another circle in that direction, where they wish the elephants to advance. When it is finished, the people stationed nearest to the new circle put out their fires, and file off to the right and left, to form the advanced party, thus leaving an opening for the herd to advance through, and, by this movement, both the old and new circle are joined, and form an oblong. The people from behind now begin shouting and making a noise with their rattles, drums, &c., to cause the elephants to advance; and as soon as they are got within the new circle the people close up, take their proper stations, and pass the remaining part of the day and night as before. In the morning the same process is repeated, and in this manner the herd advances slowly in that direction, where they find themselves least incommoded by the noise and clamour of the hunters, feeding as they go along upon branches of trees, &c. If they suspected any snare, they could easily break through the circle; but this inoffensive animal, going merely in quest of food, and not seeing any of the people who surround him, and who are concealed by the thick jungle, advances without suspicion, and appears only to avoid being pestered with their noise. As fire is the thing elephants seem most afraid of in their wild state, and will seldom venture near it, the hunters always have a number of fires lighted, and particularly at night, to prevent the elephants coming too near, as well as to cook their victuals, and keep them warm. The sentinels supply these fires with fuel, especially green bamboos, which are generally at hand, and which by the crackling and loud report they make, together with the noise of the watchmen, deter the elephants from coming near; so that the herd generally remains at a distance near the centre of the circle. Should they at any time advance, the alarm is given, and all the people immediately make a noise and use their rattles, to make them keep at a greater distance. In this manner they are gradually brought to the keddah. As soon as they all have entered the gateway, fires are lighted round the greater part of the inclosure, and particularly at the entries, to prevent the elephants from returning. The hunters from without then make a terrible noise, by shouting, beating of drums, firing blank cartridges, &c., to urge the herd on to the next inclosure. The elephants, finding themselves ensnared, scream and make a noise, but seeing no opening except the entrance to the next enclosure, and which they at first generally avoid, they return to the place through which they lately passed, thinking, perhaps, to escape, but now find it strongly barricaded; and as there is no ditch at this place, the hunters, to prevent their coming near, keep a line of fire constantly burning all along where the ditch is interrupted, and supply it with fuel from the top of the palisade; and the people from without make a noise, shouting and hallooing to drive them away. Wherever they turn they find themselves opposed by burning fires, or bundles of reeds and dried grass, which are thrust through the opening of the palisades, except towards the entrance of the second inclosure. After traversing the first inclosure, and finding no chance of escaping but through the gateway into the next inclosure, the leader enters, and the rest follow; the gate is instantly

shut by people who are stationed on a small scaffold immediately above it, and strongly barricaded, fires are lighted, and the same discordant din made and continued till the herd has passed through another gateway into the last inclosure, the gate of which is secured in the same manner as the former was. The elephants being now completely surrounded on all sides, and perceiving no outlet through which they can escape, appear desperate, and in their fury advance frequently to the ditch, in order to break down the palisade, inflating their trunks, screaming louder and shriller than any trumpet, sometimes grumbling like the hollow murmur of distant thunder; but wherever they make an attack, they are opposed by lighted fires, and by the noise and triumphant shouts of the hunters. As they must remain some time in this inclosure, care is always taken to have part of the ditch filled with water, which is supplied by a small stream, either natural, or conducted through an artificial channel from some neighbouring reservoir. The elephants have recourse to this water to quench their thirst after their fatigues, by sucking the water into their trunks, and then squirting it over every part of their bodies. While they remain in this inclosure they continue sulky, and seem to meditate their escape; but the hunters build huts around them close to the palisade, watchmen are placed, and every precaution used to prevent their breaking through.

When the herd has continued a few days in the keddah, the door of the outlet is opened, into which some one of the elephants is enticed to enter, by having food thrown first before, and then gradually further on into the passage, till the elephant has advanced far enough to admit of the gates being shut. Above this wicker gate two men are stationed on a small scaffold, who throw down the food. When the elephant has passed beyond the door, they give the signal to a man, who, from without, shuts it by pulling a string, and they secure it by throwing two bars that stood perpendicular on each side, and which cross each other in the form of the letter X, and then two similar bars are thrown across each other, behind the door next to the keddah, so that the door is in the centre. For further security, horizontal bars are pushed across the outlet, through the openings of the palisades, both before and behind those crosses, to prevent the possibility of the door being broken. The outlet is so narrow that a large elephant cannot turn in it, but, as soon as he hears the noise that is made in shutting the gate, he retreats backwards, and endeavours to force it; being now secured in the manner already noticed, his efforts are unavailing. Finding his retreat thus cut off, he advances and exerts his utmost force to break down the bars which were previously put across, a little farther on in the outlet, by running against them, screaming and roaring, and battering them like a ram by repeated blows of his head, retreating and advancing with the utmost fury. After he has fatigued himself in this confinement, strong ropes with running nooses are laid down, and as soon as he puts a foot within the noose, it is immediately drawn tight and fastened to the palisade. When all his feet have been made fast, two men place themselves behind some bars that run across the passage, to prevent his kicking them, and with great caution tie his hind legs together by passing a cord alternately from one to the other, like the figure ∞ , and then fastening these turns in the middle. A strong rope is now put twice round his body, close to his fore legs, like a girth,

and tied behind his shoulders, then the long end is carried back close to his rump, and there fastened, after a couple of turns more have been made round his body. Another cord is next fastened to the girth, and from thence carried under his tail like a crupper, and brought forward and fastened by a turn or two to each of the girths by which the whole is connected, and each turn of the cords serves to keep the rest in their places. After this a strong rope is put round his back, and made fast on each side to the girth and crupper, so as to confine the motion of his thighs, and prevent his taking a full step. These smaller ropes being properly adjusted, a couple of large cables with running nooses are put round his neck, and, after being drawn moderately tight, and the nooses secured from running closer, they are tied to the ropes on each side. While these operations are going on, the other hunters stand before the gate of the passage, tickling his trunk, and diverting his attention with a spike or a bunch of cocoa-nut leaves, or sugar canes, so that the cords, in general, are made fast without much opposition or difficulty. Occasionally, however, he will seize hold of the ropes with his trunk and endeavour to break them, particularly those which are tied about his feet, or he will try to bite them through with his grinders, but the hunters then goad him with sharpened bamboos, or very light spears, so as to make him quit his hold. Those who are employed in putting the ropes round his body and over his head, are stationed above him on a small kind of platform, consisting of a few bars run across through the openings of the palisades, and as an elephant cannot see anything that is above and rather behind his head, they are very little incommoded by him, although he appears to smell them, and endeavours to catch them with his trunk. As soon as the whole of the apparatus is secured in a proper manner, the ends of the two cables which were fastened round his neck, are brought forward to the outer end of the outlet, where two tame elephants, which are trained to the business, are waiting, and to them these cables are made fast. After every thing is prepared and ready, the door at the end of the passage is opened, and the ropes that tied his legs to the palisades are unfastened.

If the elephant is not very formidable or unruly, it is sufficient to place him lengthwise betwixt two large trees, about thirty or forty feet distant from each other, there to bind his legs in contact together, and fasten them close to one of the trees with six or seven turns of thick rope; likewise to bind one fore leg, to which greater liberty is given by the length and slackness of the cordage. The two tame elephants are then disengaged from the wild one, and conducted back by the tail to take charge of another captive. This is a very trying moment to the wild elephant. While guided by the tuition, and soothed by the society, of his subjugated brethren, he remains tranquil and quiet, appearing to forget his sorrows, and to gather fortitude under his sufferings; but immediately that his companions march away, finding himself closely bound, a solitary and helpless prisoner, he is agitated with all the horrors of despair, breaks out into a *roaring* which makes all the forest tremble, and in the fury of his extravagant grief frequently falls a sacrifice to the exertion which he makes in trying to regain his liberty. During this period, cocoa-nut leaves and plantain trees are brought to him for food. In the agony of distress,

he tosses them contemptuously away, or tramples them with indignation under his feet. The cravings of hunger, however, will after a while induce him to eat, which he does with great reluctance at first, but becomes gradually more resigned, and after the lapse of a few hours he will feed very heartily. Whole herds of elephants are taken captive in this manner; but occasionally a small party of hunters endeavour to seize the males, which often sally forth from the forests alone in search of richer provisions. In this object the hunters are frequently successful, by observing the following plan:—The places where the elephants feed are known to the hunters, they advance towards them in the evening with four trained elephants. When the nights are dark these stragglers are discovered by the noise they make in cleaning their food, by whisking and striking it against their fore legs; and by moonlight people can see them distinctly at some distance. When they have determined upon the particular elephant they mean to secure, three of the trained females are conducted silently and slowly by their drivers, at a moderate distance from each other, near to the place where he is feeding. These advance very cautiously, feeding as they go along, and have the appearance of wild elephants that have strayed from the forest. When the male perceives them approaching, if he takes the alarm, and is viciously inclined, he beats the ground with his trunk, and makes a noise, showing evident marks of his displeasure, and that he will not allow them to approach near; and, if they persist, he will immediately attack and gore them with his tusks; for which reason they take care to retreat in good time. But should he be amorously disposed, which is generally the case, he allows the females to approach, and sometimes even advances to meet them. If from these appearances the hunters judge that he will become their prize, they conduct two of the females, one on each side, close to him, and make them advance backwards, and press gently with their posteriors against his neck and shoulders. The third female then comes up, and places herself directly across his tail. So far from thinking of any design, in this situation, against his liberty, he begins to toy with the females and caress them with his trunk. While thus engaged, the fourth female is brought near with ropes and proper assistants, who immediately get under the belly of the third female, and put a small cord round his hind legs. At this time, should he move, it is easily broken, and if he takes no notice of this slight confinement, nor appears suspicious of what is going forward, the hunters then proceed to tie his legs with a strong cord, which is passed alternately by means of a forked stick and a sort of hook, from the one leg to the other, as we have described before. A very strong cable with a running noose, sixty cubits long, is next put round each hind leg, immediately above the cords, and these are secured in their places by other cords tied round the legs above them. It generally takes about twenty or thirty minutes in putting on these ropes, during which the utmost silence is observed; and the hunters who keep flat upon the necks of the females, are covered with dark coloured clothes, which serve to keep them warm, and at the same time do not attract the notice of the elephant. While the people are thus employed in tying his legs, he sometimes caresses one and sometimes the other of his seducers, examining their beauties, and toying with them, by which his

desires are excited, and his attention diverted from the hunters, and in these amorous dalliances he is indulged by the females. He is now generally so firmly secured by the pressure of the tamed elephants on each side, and by the one behind, that he can hardly turn himself or see any of the people, who always kept snug under the belly of the third female that stands behind, and serves both to keep him steady, and to prevent his kicking any of the people who are employed in securing him; but in general he is so much taken up with his decoyers, as to attend very little to anything else. In case of accidents, however, should he break loose, the people upon the first alarm can always mount on the back of the tamed elephants by means of a rope that hangs ready for the purpose, and thus get out of his reach. When his hind legs are properly secured, they leave him to himself, and retire to a small distance; but, as soon as the females go away, he attempts to follow them, but, finding his legs tied, he is roused to a proper sense of his situation, and retreats towards the forest. The hunters now follow at a moderate distance on the females, accompanied by a number of people that had been previously sent for, and who, as soon as the wild elephant passes near a stout tree, make a few turns of the long cables that are trailing behind him, around its trunk. His progress being thus stopped, he becomes furious, and exerts his utmost force to disengage himself; nor will he then allow any of the females to come near him, but is outrageous for some time, falling down, and goring the earth with his tusks.

Should the cables once break by these exertions, which sometimes is effected, and he escapes into the forest, the hunters dare not advance for fear of the other wild elephants, and are therefore obliged to leave him to his fate; and, in this hampered situation, it is said he is even ungenerously attacked by the other wild elephants. As the cables are very strong and rarely give way, such accidents seldom occur. When he has by his exertions exhausted himself, the trained elephants are again brought near, and take their former positions. After getting him nearer the tree, the people carry the ends of the long cables round his legs, then back and about the trunk of the tree, making if they can two or three turns, so as to prevent even the slightest possibility of his escape. To confine him from moving to either side, and for farther security, his fore legs are tied exactly in the same manner as the hind legs were. With all the expedition possible, he is now harnessed in the same manner as those already described, and conducted to his proper station. As soon as each of the elephants is thus secured, he is left in charge to a keeper, who is appointed to attend and instruct him, and four or five inferior servants, in order to assist and supply food and water, till he becomes so tractable as to bring the former himself.

The first object of the keeper is to gain his confidence, and, for this purpose, he constantly supplies him with food, and soothes and caresses him by a variety of little arts. Sometimes, however, the keeper threatens, and even goads him with a long stick pointed with iron, but more generally coaxes and flatters him, scratching his head and trunk with a long bamboo, split at one end into several pieces, and driving away the flies from any sores occasioned by the hurts and bruises he got by his efforts to escape. The keeper likewise keeps him cool by squirting

water over his body. In a few days he advances cautiously to his side, and pats and strokes him with his hand, speaking all the while to him, in a soothing tone of voice, and in a little time he begins to know his keeper, and to obey his commands.

The keeper at length by degrees becomes familiar to him, gets upon his back from one of the tame elephants, and as the animal becomes more tractable, he advances gradually forward, till at last he is permitted to seat himself on his neck, from which place he afterwards regulates all his motions. The iron hook with which they direct him is pretty heavy, about sixteen inches long, with a straight spike advancing a little beyond the curve of the hook. When he wishes to turn him, he catches one of his ears with this instrument, and by pressing it into his skin makes him move in any direction that is required. While he is training in this manner, the tame elephants lead out the others in turn for the sake of exercise, and likewise to ease their legs from the cords with which they are tied, and which are apt to gall them severely, unless they are regularly slackened and shifted. In the course of five or six weeks, the elephant becomes obedient to his keeper, his fetters are taken off by degrees, and generally in about five or six months he suffers himself to be conducted by his keeper from one place to another. Care, however, is always taken not to let him approach his former haunts, lest a recollection of the freedom he enjoyed there should induce him to recover his liberty again. This obedience to his conductor seems to proceed partly from a sense of gratitude, as it is in some measure voluntary; for whenever an elephant takes fright, or is determined to run away, all the exertions of the keeper cannot prevent him, even by beating or digging the pointed iron hook into his head with which he directs him. On such an occasion, the animal totally disregards the feeble efforts, otherwise he could shake or pull him off with his trunk, and dash him to pieces. Accidents of this kind happen almost every year, especially to those keepers who attend the large males, and are in general owing to their own carelessness and neglect.

The males are treated with much greater severity than the females which is necessary to keep them in awe; but it is too common a practice among the keepers either to be negligent in using proper means to render their elephants tractable, or to trust too much to their good nature, before they are acquainted with their dispositions thoroughly.

It will readily be understood that, in order to repay all the labour and compensate all the risk with which their capture is attended, elephants, when taken and trained to docility, must be of great value; and perhaps we cannot give a more correct estimate, whereby the value of an elephant may be compared with that of other animals employed in draft or carriage, than by stating that a male elephant full grown, of the largest size, and in the best health and condition, can carry about a ton weight, and travel with it fifty miles in the course of twenty-four hours; and that, if properly used, he may perhaps retain this power for a century or even more; so that he who purchases a good elephant may be said to purchase an estate for his grandchild. Carrying is not the only useful purpose to which those powerful animals can be applied; for their weight and strength tell equally in traction; and in this respect their strength tells much more in proportion to the strength of horses or bul-

locks than it does in carrying. In using a team of horses, the proportional expense increases, and that at a pretty rapid rate, in proportion to the number used. The reason of this is obvious: the horses cannot by possibility pull exactly together, however nicely they may be matched in point of size and strength. This will hold good in the case of two, and much more in the case of a greater number; so that the greater the number in every horse team, the greater the expense of every pound weight that that team pulls along. This is a disadvantage in the employment of combinations of small animals of which no ingenuity and skill can get the better; and though it is not very apparent in countries which are intersected in every direction by roads planned on the most scientific principles and executed and kept in repair in the best manner (which might be, if it is not, the case in England); yet if we are to suppose a country where such roads cannot be generally made or maintained, then we can understand something of the value of such an animal as the elephant.

There was a time when most of the merchandise and produce, which was carried inland in England, had to be carried on pack horses; and then if the distance was a hundred miles, or even fifty, the price of the carriage was nearly equal to that of the common produce of the earth; and thus, the several districts of the country were cut off from each other; and it was no uncommon occurrence for the people of one district to be dying of famine, while there was an abundant surplus in another district, but no means of fetching that surplus to the needy of which the expense could at all be borne.

India is a country which from its geographical formation, its physical character, and its vast extent, can never be intersected by wheel-carriage roads as England is. In the first place taking the mere extent, the wealth of the world would not suffice for making the requisite length of roads for such a country. In the second place, the transition from the lower districts to the higher in southern India is so abrupt, that wheel-carriage roads are in many instances entirely out of the question; so much so that after the British armies had laboured as much as they could at the making of such roads, they found it necessary to dismount their guns from the carriages, and call in the assistance of the elephant to pull them up. In the third place, the rains in India, when they do come, come with such violence, especially upon the steeps where the construction of roads is most expensive, that they uproot the trees and tear the rocks in pieces, and of course no road, let it be constructed as it may, could withstand the violence. Many places of India must therefore, of necessity, always remain what we may call a burthen country; and as either for a carriage on the back, or a dead pull, an elephant concentrates into one effort a power equal to that of a great number of other animals, the elephant must become more valuable in India, in proportion as the country improves. Since the British ascendancy was complete, India is in a fairer way to improvement than it ever was at any period of its history, long as that history is. It is now safe from those external invasions by which it was so often and so cruelly plundered in former times: and we may hope that it is equally safe from those internal commotions which were probably more calamitous and destructive. Thus, though India is among the oldest countries upon the historic record, it is what may be

called an infant country in respect of the reciprocal intercourse of its different districts for the welfare of the whole.

It is on this account that, with reference to India, the elephant has become more interesting than it was at any former period. In the mere parade of an army, or in the march of a nabob, it may be a piece of gorgeous folly; but if it can be employed to fetch from one district that which shall relieve the wants of another, and stimulate, and by stimulating reward, the industry of both, then the elephant takes a higher rank in the scale of utility than has hitherto been given it, even by those who have doted and dreamed about its rational powers, and even were those powers real, they would sink it to nothing in comparison of the usefulness of the animal as a beast of burden, to India in a state of union and general industry. It is from a feeling of this kind that we have been induced to go a little more into the history of this noble animal, (and viewing it as an animal it is truly a noble one,) than we otherwise might have done; and this will justify us in adding a little more, in order to remove a pretty general prejudice that there is against the elephant, on account of the supposed length of time which it harbours revenge, and the indignity it feels at being made subservient to the use of man. So far as we have been able to carry our observation and experience, nature bears out the declaration of Holy Writ that the dominion of man over the rest of the world is universal; and that, whenever he fails in it, it is in consequence of his own ignorance—ignorance either of the proper use of the creature, or of the means of applying it to that use.

For the means of demonstration here we must again have recourse to the grand authority for rational information on the subject of the elephant, Mr. Corse Scott; and we have the less hesitation in doing so, that while Mr. Scott conveys nothing but the truth, and no truth but that which is really and practically useful, he contrives at the same time to make all his statements very pleasant reading; so that his plain matter-of-fact has more charm in it than the romance of almost any other man. "In June 1787," says Mr. C. Scott, "Jalra Mungul, a male elephant taken the year before, was travelling in company with some other elephants towards Chittagong, laden with a tent and some baggage, for our accommodation in the journey. Having come upon a tiger's track, which elephants discover readily by the smell, he took fright, and ran off to the woods, in spite of the efforts of the driver. On entering the wood, the driver saved himself by springing from the elephant and clinging to the branch of a tree under which he was passing. When the elephant got rid of his driver, he soon contrived to shake off his load. As soon as he ran away, a trained female was despatched after him, but could not get up in time to prevent his escape; she, however, brought back his driver, and the load he had thrown off, and we proceeded without any hope of ever seeing him again. Eighteen months after this, when a herd of elephants had been taken, and had remained several days in the inclosure, till they were enticed into the outlet, then tied and let out in the usual manner, one of the drivers, viewing a male elephant very attentively, declared he resembled the one which had run away. This excited the curiosity of every one to go and look at him; but when any person came near, the animal struck at them with his trunk, and, in every respect, appeared as wild and

outrageous as any of the other elephants. At length an old hunter coming and examining him narrowly, declared that he was the very elephant that had made his escape about eighteen months before. Confident of this, he boldly rode up to him on a tame elephant, and ordered him to lie down, pulling him by the ear at the same time. The animal seemed quite taken by surprise, and instantly obeyed the word of command with as much quickness as the ropes with which he was tied permitted; uttering, at the same time, a peculiar shrill squeak through his trunk, as he had been formerly known to do, by which he was immediately recognised by every person who had ever been acquainted with this peculiarity. Thus we see that this elephant, for the space of eight or ten days during which he was in the inclosure, and even while he was tying in the outlet, appeared equally wild and fierce as the boldest elephant then taken, so that he was not even suspected of having been formerly taken till he was conducted from the outlet. The moment, however, he was addressed in a commanding tone, the recollection of his former obedience seemed to rush upon him at once, and without any difficulty he permitted a driver to be seated on his neck, who, in a few days, made him as tractable as ever."

This account of the sagacity of the elephant we shall conclude, by quoting some of those stories which have been commonly related as illustrative of the degree of intellect which he is supposed to possess, for the purpose of gratifying the general reader. In the eastern countries which are still under the controul of the native rulers, the elephant is sometimes exhibited in a manner similar to that in which wild beasts were on the arena of the Roman amphitheatres. We shall give one instance of an engagement between elephants and a tiger, in which great injustice appears to have been done to the latter animal. It is related by Mr. Finlayson, in his account of the mission to Siam and Hué, and took place on a grassy spot about half a mile each way; the governor, the mandarins, and the soldiers being present on the occasion. The tiger was bound to a stake in the centre of the plain, the claws being torn out, and his lips being stitched together. He was turned loose, and attempted to escape, but in vain: he next threw himself at length upon the grass, till, seeing a large elephant with long tusks approach, he rose and faced the coming danger. The elephant was, by this attitude, and the horrid growl of the tiger, too much intimidated, and turned aside; while the tiger pursued him closely, and struck him with his fore paw upon the hind quarter, quickening his pace not a little. The elephant being brought back to the charge, rushed on furiously, driving his tusks into the earth under the tiger, and, lifting him up, cast him about thirty feet. The tiger lay as if dead, yet he had sustained no material injury; for, on the next attack, he threw himself into an attitude of defence, and, as the elephant was again about to take him up, he sprung upon his forehead, fixing his hind feet upon the trunk of the former. The elephant was wounded, and so frightened that he fairly ran off, and could not be rallied to the fight again. Another elephant was now brought, but the tiger made less resistance, it being evident that the tosses he received must soon occasion his death. Other elephants with tusks were brought forward: their attack was in every instance by rushing upon the tiger, thrusting their tusks under him, and throwing him to a distance. Of their trunks they were evidently very careful, rolling them cau-

tiously under the chin. When the tiger was perfectly dead, an elephant was brought up, who, instead of raising him with his tusks, seized him with his trunk, and cast him to the distance of thirty feet.

Elephants in India were once employed in the launching of ships. One was directed to force a very large vessel into the water, but which proved superior to his strength. In a sarcastic tone of voice his master desired the keeper to take away the lazy beast, and bring another in his stead; the distressed animal instantly increased his efforts, in doing which he fractured his skull on the spot.

An elephant in Delhi, passing along the streets put his trunk into a tailor's shop, where several people were at work; one of them pricked the end of it with his needle. The beast passed on; but in coming to the next dirty pool of water filled his trunk with it, and returned apparently in great wrath back to the shop, where, upon arriving, he discharged the whole contents over those who had offended him, and entirely spoiled their work.

An elephant in Ajmeer, which passed frequently through the bazaar or market, as he went by a certain herb woman, always received from her a mouthful of greens. At length he was seized with one of his periodical fits of rage, broke from his fetters, and, running through the market, put the crowd to flight, and among others this woman, who in haste forgot a little child she had brought with her. The animal, gratefully recollecting the spot where his benefactress was wont to sit, laid aside his fury, and taking up the infant gently in his trunk placed it safely on a stall before a neighbouring house. In the Dekan, another elephant, not having received some arrack which had been promised by the cornac, or governor, by way of revenge killed him. The cornac's wife, who was an eye-witness to this, took her two children and flung them before the elephant, saying, "Now you have destroyed their father, you may as well put an end to their lives and mine." He instantly stopped, relented, took the biggest of the children, placed him on his neck, adopted him for his cornac, and never afterwards would permit any body else to mount him.

There was a soldier at Pondicherry, who was accustomed, whenever he received his share of liquor, to carry a certain quantity of it to one of these animals, having drunk rather too freely one day, and finding himself pursued by the guards, who were going to take him to prison, he took refuge under the elephant's body and fell asleep. The guard tried to force him from this asylum in vain, as the elephant protected him with his trunk. The following morning, the soldier recovering from his drunken fit, shuddered with horror to find himself stretched under the belly of this huge animal. The elephant, which, without doubt, perceived the man's embarrassment, caressed him with his trunk in order to inspire him with courage, and made him understand that he might now depart in safety.

A painter was desirous of drawing the elephant, which was kept in the menagerie at Versailles, in an uncommon attitude, which was that of holding his trunk raised up in the air, with his mouth open. The painter's boy, in order to keep the animal in this posture, threw fruit into his mouth; but as he had frequently deceived him, and made him an offer only of throwing the fruit, he grew angry, and, as if he had known the painter's intention of drawing him

was the cause of the affront that was offered him, instead of revenging himself on the lad, he turned his resentment on the master, and taking up a quantity of water in his trunk, threw it on the paper which the painter was drawing on and spoiled it.

In Britain it was some time ago found necessary, in consequence apparently of the declining interest of the drama, as performed by human beings, to introduce the elephant on the boards as an actor; and whether we may consider that this introduction did or did not contribute to establish the taste of that nation which produced Shakspeare, the histrionic elephant became the most renowned actor of its time. A female elephant was thus made to take a part, in short to become an actor requisite to the plot of a dramatic performance at the Adelphi Theatre, several years since. Among her feats was that of uncorking and drinking several bottles of wine, and supping with her stage companions around her. Above all, she assisted the escape of some of the *dramatis personæ* from prison, by kneeling upon her hind legs, and thus forming an inclined plane for the safe descent of her friends; and this she did unmoved by the glare of numerous lights, the sounds of music, and shouts of the admiring audience.

Among the most interesting elephants kept in this country, without any reference to profit, was one which was lately at the Duke of Devonshire's villa at Chiswick. When a lady departed for India, she asked the duke in a sportive manner, what present she should send him from that land of marvels; and in an equally sportive mood, the duke replied, "Certainly nothing less than an elephant." The matter passed over, but in due time the present came, and as long as the elephant lived it was a very interesting animal. It was a female, perhaps not altogether full grown, but remarkable for the gentleness of its disposition; and from the kindness with which it was treated, and the free range that was allowed to it, it probably came nearer to an elephant in a state of nature than any other which ever appeared in this country. The house erected for her shelter was of large dimensions and well ventilated, and she had besides the range of a paddock of considerable extent. At the call of her keeper she came out of her house, and immediately took up a broom ready to perform his bidding in sweeping the grass or paths. She would follow him with a pail or watering-pot round the enclosure. Her reward was a carrot and some water; but previously to satisfying her thirst she would exhibit her ingenuity by emptying the contents of a soda water bottle which was tightly corked. This she did by pressing the bottle against the ground with her foot, so as to hold it securely at an angle of about forty-five degrees, and gradually twisting out the cork with her trunk, although it was a very little above the edge of the neck; then, without altering the position, she turned her trunk round the bottle, so that she might reverse it, and thus empty the contents into the extremity of the proboscis. This she accomplished without spilling a drop, and she delivered the empty bottle to her keeper before she attempted to discharge the contents of the trunk into the mouth. The affection of this poor animal for her keeper was so great, that she would cry after him whenever he was absent for more than a few hours. She was about twenty-nine years old when she died, early in the year 1829, which was understood to be of a pulmonary consumption.

We shall now very briefly notice the distinguishing characteristics of the several species of elephants.

In the INDIAN ELEPHANT, or more correctly the South Asiatic elephant, to which the chief part of the preceding observations apply (*Elephas Indicus*), the following are the general characters: the skull elongated; the forehead flat and even concave; the enamel which forms the cutting part of the grinders disposed across the teeth in a series of flattened ovals; the ears large; and five horny nails on each of the fore feet, and four on each of the hind. In this species the females, and in some varieties the males, also, have the tusks very short, and nearly straight; the ears of the female are smaller than those of the male, and the colour is dull grey speckled with brown, and occasionally with a little white; and species entirely white are mentioned, which are, in all probability, albinos, but which are held in great and even sacred regard by some of the natives.

In the East Indies, elephants as well as Hindoos, are divided into castes, only there are not quite so many of the former as of the latter. In Bengal, and we believe, generally, in those places of India where elephants are much used, they are divided into two castes: *Koomareah*, princely, or nabob elephants; and *Merghee*, or hunting elephants. The *Koomareah* or nabob race is a deep bodied, compact, and very strong animal, having a very large trunk (which is always esteemed a great beauty in an elephant), legs short, but thick in proportion to the size of the animal. This variety is preferred, as it is of superior strength, can undergo much greater fatigue, and carry heavier burdens than the others: an elephant of the *Merghee* cast, when full grown, is generally taller than the former, but has not such a compact form; his legs are longer, he travels faster, has a much lighter body, and his trunk is both short and slender in proportion to his height. There appears no predilection in any of these elephants to have exclusive connection with his own particular caste, and hence the mixed breed is held in greater or less estimation, in proportion as it partakes of the qualities of the *Koomareah*, or *Merghee* caste. In some elephants the tusks are large, as in the variety named *Dauntelah*, in which they generally project forwards, and curve upwards. In the variety termed the *Mooknah*, the tusks are very small and straight, and point almost directly downwards.

This species of elephant is said to be perfect when the ears are large and rounded, but not so if the ears are ragged and indented at the margin; his eyes are of a dark hazel colour, and free from specks; the roof of his mouth and tongue are without dark spots of any considerable size; his trunk large, his tail long with a tuft of hair at the extremity, reaching nearly to the ground. There must be five nails on each of the fore feet, and four on each of the hind ones, making in all eighteen; he carries his head high: the arch or curve of his back gradually rising from the shoulder to the middle, descending from thence to the insertion of the tail.

The species now under notice is peculiar to the low grounds of Asia, southward of the central mountains; though it is not confined to the main land, but is found abundantly in many of the islands, and especially in Ceylon. In the more remote islands of the eastern sea, it is not met with, nor is there a single vestige of it, or of its bones, in the whole extent of Australia. Indeed, it is worthy of remark, that while

the bones of the fossil elephant of the north, of which, probably, not a single specimen has been alive since the historic record commenced, are found in such numbers, the bones of the living elephant should rarely be met with. No doubt there is a much stronger conservative principle in the cold atmosphere of the north than in the warm one of the south, especially where that atmosphere is humid as well as warm, as it is in all the places which are inhabited by elephants; and, perhaps, when we consider that in the elephant countries the action of the weather alone suffices in brief space to crumble buildings of stone into heaps, we should in all probability not wonder very much, though it should speedily reduce the bones even of elephants to their constituent earths.

AFRICAN ELEPHANT (*Elephas Africanus*). In its general aspect, this species does not differ very much from the former. Its leading characters are: the skull rather shorter than in the Indian species; the forehead rounded, and protuberant in the middle rather than hollow; the enamel in the grinders formed into a sort of lozenges, which are larger and fewer in number than those in the teeth of the Indian elephant; the ears are also larger, rise up much higher above the general line of the head, and extend farther backwards, so far, indeed, as to reach and partially to cover the shoulders. The tusks of this species are perhaps larger in proportion than those of its Asiatic congener, and they are of more equal size in the two sexes, those of the female being nearly equal in size to those of the male. The tusks are also of more compact texture; so that African ivory is of more value than Asiatic, as being susceptible of a finer polish, and also stronger. We believe that there are some rare instances in which the strength of this animal has been pressed into the service of man; but they are exceedingly rare, and the animal must still be considered as a free tenant of the forest. It is found in all the rich and wooded countries, from the Cape of Good Hope to the Desert of Sahara, but not to the northward of the Desert, or in Egypt, or indeed in any part of the valley of the Nile, or at least of Sennar, to the northward as far as the Abyssinian mountains. The elephant indeed is but ill adapted for climbing heights, from its great weight; and therefore we may naturally suppose, that as a southern animal it must be bounded by such mountains as those which we have mentioned.

The African elephant is inferior in size to the Asiatic; but it seems rather more hardy. It is equally remarkable for the acuteness of its sense of smelling; and some remarkable instances are told of its powers in distinguishing enemies. As it is hunted for destruction much more than the Asiatic elephant, it is probably rendered more ferocious by this means; though it is not very easy to see upon what principle the destruction of one animal in hunting should make others of the same race more fierce towards the hunters. It is for the sake of its tusks chiefly that this elephant is hunted in the vicinity of the Cape; though the Hottentots eat the carcase with zest; and the ears, which are very strong as well as large, are made use of as a sort of sledge. We shall give the substance of one or two anecdotes from Sparrman, as illustrative of the character of this animal. The first shall be that of two farmers or boors, who began the occupation at once without any training. On the evening the wild elephant was observed, they

resolved to pursue it on horseback, though it was the first time they had ever seen one. Their horses, though equally unaccustomed to the sight as their riders of this gigantic-like animal, yet were not in the least frightened; nor did the elephant indeed appear to give himself any trouble about them, until they were within seventy or eighty paces of him. At about that distance, one of the party, agreeably to the usual manner of the Cape huntsmen, leaped from his horse, and fastening the bridle dropped on one knee, and with his left hand sticking his ramrod into the ground rested his gun upon it, took his aim, and fired at the elephant, which had then got about forty or fifty paces further off; for when they hunt the larger kind of animals in this country, they generally choose the opportunity of firing at the distance of from 100 to 150 paces, both because they load their pieces in such a manner that the ball may, as they think, do more execution at that distance, and that they can also gain time to mount their horses again and ride off before the wounded animal can make up to them to take his revenge. Our sportsman had scarcely got into the saddle, and turned round his horse's head, before he ascertained that the elephant was at his heels. At this very instant the animal set up a shrill piercing cry, which he imagined to pierce to the very marrow of his bones, and which occasioned his horse also to make several hasty leaps, and then gallop off as fast again as before. In the meantime, the huntsman had sufficient presence of mind to ride his horse up an ascent, well knowing that elephants and other heavy animals are unwieldy and slow in ascending up a hill, in proportion to their weight, and the reverse in descending a hill. By this means, he not only more certainly distanced his antagonist, but his companion had more time to advance on one side of the elephant, where he imagined he could most easily direct the shot at the heart, and the larger arteries connected with the lungs of the animal. This shot did not, however, hit in any dangerous part, as the horse was rather unruly, and pulled at the bridle, which the man had hanging over his right arm, at the instant that he jumped off his horse and discharged his piece in the same manner as the former had done. This now turned the elephant upon this last antagonist, but he was soon wearied of pursuing him, as the sportsman had an opportunity of riding away from him up a still much steeper hill than his companion.

The two hunters now found that it would suit their purpose better to hold each other's horses, so that they need not get off, while each of the sportsmen fired their pieces by turns. The elephant, even after the third ball, still threatened vengeance; but the fourth shot had the effect of reducing his violence, although he did not fall till he had received the eighth one. Of course none of the balls aimed at him had taken effect in a part immediately vital, because when struck there the elephant will fall at a single shot. We shall mention one other anecdote of the pursuit of this animal; and we give it because it is illustrative of the acuteness of the animal's sense of smell. It was related to Sparrman by a hunter of the name of Dirk Marcus, of course a Dutchman. "Once," says Dirk, "in my younger days, when from a hill covered with bushes near a wood I was endeavouring to steal upon an elephant to the leeward of me, on a sudden I heard a frightful cry or noise from the lee side, and although I was at that time one of the boldest elephant hunters in that

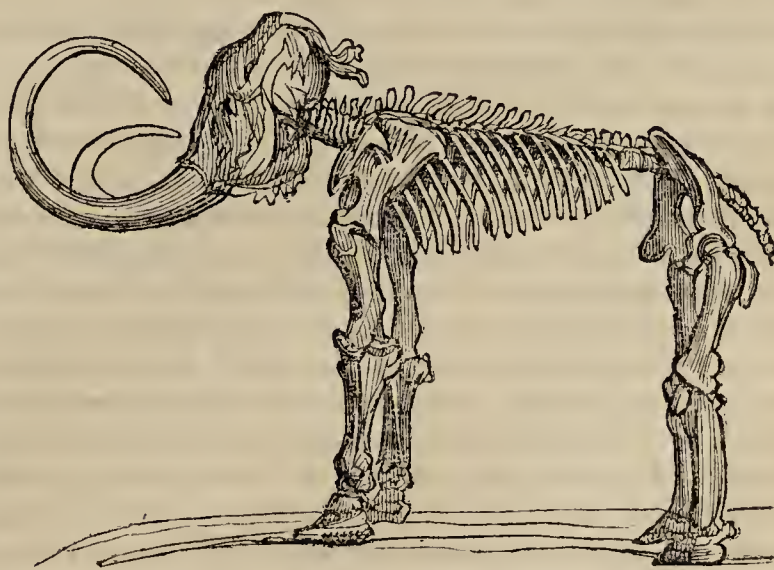
country, I must confess I was in a terrible quaking, so much so that I believe the hairs on my head stood quite erect. At the same time it appeared to me as though I had several pails of water thrown over me, without my being able to stir from the spot, until I saw this huge creature so near me that he was almost on the point of laying hold of me with his trunk. At that instant I fortunately had the presence of mind to take to my legs, and to my no small astonishment I found myself so swift that I thought I hardly touched the ground. The beast, however, was pretty close upon my heels; but having at last got to the wood, and crept away from him under the trees, the elephant could not easily follow me. I am quite certain that he could not see me in the place where I was at first, and that therefore he must have found me out by the scent." So much for the escape of Dirk Marcus, the Dutch boor, whose story no doubt contains a good deal of the marvellous. Indeed it is not an incurious matter in the history of mankind, that while, upon all ordinary subjects, the Dutch are the most matter-of-fact people on the face of the earth, they are the greatest romancers in matters of adventure and of natural history; and it is possible, indeed probable, that more unfounded but marvellous stories of this kind originated with the early Dutch navigators than with any other people on the face of the earth.

But even Dirk Marcus was probably not so brave an elephant hunter as the wild bushmen of the Cape, whom the Dutch settlers used to be as zealous in hunting and shooting in cold blood, as they were in hunting elephants, or in carrying on a campaign of extermination against the antelopes. The bushmen not only shoot elephants with their poisoned arrows, but come to close quarters with their assagais or spears, with which they stick the great animal all over till he is bristled like a porcupine, and the pain often causes him to accelerate his own death; as from his natural instinct of falling upon and crushing the lion, when it springs on the hinder part of his body, he falls upon the spears, and by this means pushes them home to his vitals. When the inhabitants of one of the kraals or villages of those rude people catch an elephant, it is a day of as much joy as when the Greenlanders capture a whale. The flesh of the elephant is cut up in ribbons, as is done with beef in South America, and in many parts of Old Spain; and this elephant beef, by being suspended in the open air, and dried in the intense heat of the sun, can be kept for a considerable time, and is said not to be very unpalatable. The trunk is an especially delicate morsel, because the muscles in it, though very numerous, are small, and much more delicate in their fibres than the common muscles of motion in the body of the animal. The feet, also, are very much prized, though chiefly on account of the cartilaginous substance on the soles. To a European, however, an elephant feast would, probably, be but a sorry meal.

Independently of his living only in the wild state, and inhabiting woods of more savage character than those of Asia, there is a sullenness in the air and expression of the African elephant. His head is carried much lower, and less gracefully than that of the Asiatic species; and the apparent shortness of the face, the want of squareness in the outline, and the bullet-shape of the cranium, all conspire to take off from him that expression of sagacity which is, probably, more imaginary than real in his oriental congener.

The greater size of the tusks, too, in proportion to that of the animal, tends to increase this expression. But notwithstanding all these disadvantages of appearance, the African elephant is a highly interesting as well as powerful animal; and one almost regrets that, even for the sake of bushmen feasts and ivory trinkets, he should have been hunted down with so much assiduity in those wild woods which, as they are not taken possession of by civilised man, might have remained as birthright pastures of the elephant. In consequence of this there are now few or no elephants except at a considerable distance from the Cape, though in the woods farther to the north they are still numerous.

THE FOSSIL ELEPHANT (*Elephas primogenitus*). It is doubtful whether as much interest has not been excited, not among the students of nature only, but even by the mass of the inhabitants in those places where its remains are abundant, by this extinct animal, as by at least the African species of the living one. The characters are: the skull lengthened and the forehead concave, as in the Asiatic elephant; the under jaw much more obtuse than in either of the living species; the grinders larger, with the enamel disposed in transverse bands or ribbands set closely together; and the sockets of the tusks much more produced than those of the others, as if these organs had some more laborious office to perform. This peculiar lengthening of the sockets, and general enlargement of the anterior extremity of both jaws, is conclusive evidence that the trunk of this elephant must have been thicker at its base or junction with the head; and renders it probable that, if not a more universal instrument, it may have been a more powerful one than the trunk of either of the existing elephants. From the skeletons, it is not probable that this lost animal was of taller stature than his living congeners; but from the enlargement of some of the processes of the bones, and various other circumstances connected with the skeleton, there is some reason for believing that it must have been of thicker body and more robust frame, than are the elephants which still exist. The following cut will furnish some idea of the skeleton of this animal; and any one who has seen a live elephant will feel no great difficulty in imagining it clothed with flesh.



It is not for what this animal has been in itself when alive, and acting its part in living nature, that it claims our attention; for it forms a curious section in the history of human belief, as well as in that of progressive zoology. If its remains had occurred only in those countries over which the conquests of the ancient

nations of the east, or even of the Romans, had extended, then the remains might have been considered as those of elephants which had been marched in the trains of the conquerors, at least until science had established those specific differences between them which are now so well made out.

But those remains have been found most abundantly in countries which, in all probability, the foot of southern conquest never trod; while in the range of that conquest, and especially that part of it where elephants were more likely to have accompanied the armies, these remains are unknown. It is not probable that any southern conqueror of early times ever crossed the Carpathian mountains, or the central marshes, or even the southern steppes of European Russia; and it is equally improbable that any such conqueror ever crossed either the central desert of Asia or the Altaian ridge, so as to penetrate into Siberia; and yet it has been found that the remains of those elephants are so numerous in many parts of that country, that they form large banks, and almost entire islands, in the lower parts of the great rivers near their confluence with the Polar Ocean. These are so numerous, and the tusks are in a state of such preservation, that they form an article of commerce as ivory. It is true that for a long period the natural history of Siberia was very little known, and the vast number of the remains of the fossil elephant there were known only to the few savage hordes who carry on their hunting during the summer in those dismal wastes; and it is still more recently that those remains have been either found in an entire skeleton with their natural connections, or that men sufficiently skilled in comparative anatomy have joined them bone to bone, in the same relative situations which they must have held during the lives of the animals.

Previous to this period they had been found in various parts of Europe, indeed partially in all parts of it, from the shores of the Mediterranean to those of the Icy Sea; on the main land, most frequently in the lower valleys, or near the estuaries of the larger rivers. But they were not confined to the continent, for they were observed in the British Islands, and even in Iceland, distant as that island is from the European shores; but how they found their way to such remote places is a point which has not been and which probably cannot be determined.

Before science was applied to the rational solution of natural phenomena, those bones gave rise to singular conjectures. Where only a bone or two was met with, these were, generally speaking, considered as human bones, as the remains of some giant race which had peopled the world in times anterior to all memory. This belief accorded well with the superstitions of the northern nations, who are still inclined to ascribe the erection of every ruin of which the history is lost, as well as the production of many of those singular appearances which rocks and the other permanent works of nature exhibit in these wild places, to the labours of the giants; but when it came so far as the finding of a tusk, of such dimensions as some of those fossil tusks are, it tended to upset the theory of the giants; for though many of these had "terrible teeth," according to the generally believed legends, the tusks of an elephant, weighing some sixty or seventy pounds each, were rather too much for a giant even of the first class.

In this way the bones were, in the course of time, acknowledged to be the bones of elephants; but as it

was not supposed, or even thought of, that elephants of a race now lost could ever have inhabited the cold regions in which those bones are most plentifully found, a new belief was taken up; and they were the bones of the present race of elephants which had been transported thither by some great convulsion of nature.

Nor was there any difficulty in finding out a convulsion sufficient for the performance of this transfer; for in those days the fact of a universal deluge was held perfectly sufficient for the solution of every difficulty which could not be solved by any other means; and if any thing, be it what it might, was found in the earth in a way that nobody could account for, then all perplexity was solved by the simple allegation that it had been "brought there by the flood." It never occurred to those resolvers of difficulties, that it was incumbent on them to inquire what a flood of water covering the earth could do; whether it could move large bones from the valley of the Ganges to the regions of the Pole; and especially whether it could place them in the situations in which they were found. When those things came to be thought of, it was soon discovered that the explanation by a deluge would not satisfy the question. The bones were placed in strata apparently deposited at different times, so that several floods would have been required; and the different bones of the same animal were found so near each other, that it was impossible not to see that the animal must have been brought entire to those situations in which the bones were found.

Of the fossil elephant the most perfect specimen, and the one which put us completely in possession of the anatomy of the animal, is that which was cast ashore, frozen up in an icy tomb, upon the north coast of Asia, about the close of the last century. In the year 1799, a Tungusian fisherman observed a strange shapeless mass projecting from an icebank near the mouth of a river in the north of Siberia, the nature of which he did not understand, and which was so high in the bank as to be beyond his reach. The next year, he observed the same object, which was then rather more disengaged from amongst the ice, but he was still unable to conceive what it was.—Towards the end of the following summer, 1801, he could distinctly see that it was the frozen carcase of an enormous animal, the entire flank of which, and one of its tusks, had become disengaged from the ice. In consequence of the ice beginning to melt earlier, and to a greater degree than usual, in 1803, the fifth year of this discovery, the enormous carcase became entirely disengaged, and fell down from the ice-crag on a sand-bank, forming part of the coast of the Arctic Ocean. In the month of March of that year, the Tungusian carried away the two tusks, which he sold for the value of fifty rubles; and at this time (says Cuvier, whose relation we quote) a drawing was made of the animal, of which I possess a copy. Two years afterwards, or in 1806, Mr. Adams went to examine this animal, which still remained on the sand-bank where it had fallen from the ice; but its body was then greatly mutilated. The Tungots of the neighbourhood had taken away considerable quantities of its flesh to feed their dogs; and the wild animals, particularly the white bears, had also feasted on the carcase: yet the skeleton remained quite entire, except that one of the fore legs was gone. The entire spine, the pelvis, one shoulder-blade, and three legs, were still held together by their ligaments, and by some remains of the skin;

and the other shoulder-blade was found at a short distance. The head remained covered by the dried skin, and the pupil of the eye was still distinguishable. The brain also remained within the skull, but a good deal shrunk and dried up, and one of the ears was in excellent preservation, still retaining a tuft of strong bristly hair. The upper lip was a good deal eaten away, and the under lip was entirely gone, so that the teeth were distinctly seen. The animal was a male, and had a long mane on its neck. The skin was extremely thick and heavy, and as much of it remained as required the exertions of ten men to carry away, which they did with considerable difficulty. More than thirty pounds' weight of the hair and bristles of this animal were gathered from the wet sand-bank, having been trampled into the mud by the white bears while devouring the carcase. Some of the hair was presented to our Museum of Natural History, by M. Targe, censor in the Lyceum of Charlemagne. It consists of three distinct kinds. One of these is stiff black bristles, a foot or more in length; another is thinner bristles, or coarse flexible hair, of a reddish brown colour; and the third is a coarse reddish brown wool, which grew among the roots of the long hair. These afford an undeniable proof that this animal had belonged to a race of elephants inhabiting a cold region, with which we are now unacquainted, and by no means fitted to dwell in the torrid zone. It is also evident, that this enormous animal must have been frozen up by the ice at the moment of its death. Mr. Adams, who bestowed the utmost care in collecting all the parts of the skeleton of this animal, proposes to publish an exact account of its osteology, which must be an exceedingly valuable present to the philosophical world. In the meantime, from the drawing (says Cuvier) which I have now before me, I have every reason to believe that the sockets of the teeth of this northern elephant have the same proportional lengths with those of other fossil elephants, of which the entire skulls have been found in other places. Many curious and important facts are presented by the geographical distribution of remains of this species. They have been dug up in most of the countries of Europe, from the Mediterranean sea to the Arctic circle. The greatest abundance of them occur in Asiatic Russia. In the European isles they have also been found, in Iceland, and several parts of Great Britain and Ireland; and their bones have even been dug up in North and South America, and in Hudson's Bay. We have given these particulars of the fossil elephant, as well as of the living ones, rather more at length than we can afford to do in the case of most subjects, partly on account of the direct interest of the subjects themselves, and partly because of the mistakes respecting them, which are still current among many people.

ELEPHANT'S FOOT is the *Testudinaria elephantipes* of Burchell. It is a native of the Cape of Good Hope, and remarkable for having the collet or crown of the roots swollen to a very large size, and covered with a tessellated bark of very curious structure. Both roots and stems are comparatively slender and fugitive; but the tuberos body is very durable, there being some individuals at the Cape which indicate two hundred years growth. A new layer of liber being added every year, these may be easily counted on the edges of the fractured portions of the exterior surface.

ELEPHANTOPUS (Linnæus). A genus of West Indian herbaceous perennials, met with in stove col-

lections, but of no great beauty. It belongs to *Compositæ*, and is easily propagated by cuttings struck in sand.

ELICHRYSUM, an exploded genus of plants of Willdenow's, now included in that of *ASTELMA*, which see.

ELK. See the article **DEER** for a full description of this animal.

ELLIPSOSTOMATA (De Blainvillê). This forms the third family of the second order *Asiphonobranchiata*; second class *Paracephalophora*. The general character of the shells forming this family is that of possessing a longitudinal oval aperture, sometimes transversely and completely closed by a calcareous or horny operculum. The form of these shells varies, and they are generally smooth. The family is constituted of the genera *Melania*, *Rissoa*, *Phasianella*, *Ampullaria*, *Helicina*, and *Pleurocerus*.

ELMIDÆ. A family of minute coleopterous insects belonging to the section *Pentamera* and subsection *Philhydrida*, being of short form, and having the legs formed for crawling, and the tarsal claws large; the palpi are short and the head inflexed. There are two genera, *Georyssus*, Latreille, and *Elmis*, (*Limnius*, Müller), of which the species are found under stones at the bottom of running brooks. In this situation the larvæ also reside. The writer has taken some of the species of *Elmis* from stones in water a yard deep. The structure of the organs of respiration of these sub-aquatic species offers a very interesting subject of research.

ELM TREE is the English name of the different species of the genus *Ulmus* of Linnæus. The elm is one of our principal timber trees for usefulness, ranking next to the oak. There are nineteen species already described, six of them marked as natives of Britain. The most valuable of all, *U. campestris*, the common English elm, although completely naturalised, is certainly not a native, as it is never met with in forests, nor ever far from buildings, or marking the place where buildings have formerly stood. Neither does it ripen seeds in this country, showing that it is a native of a warmer climate.

It has been stated that the English elm was introduced into this country from Palestine during the crusades; but however this might have been, it is very probable, from present appearances, that there was once a time when it was very fashionable to plant this tree. The oldest and finest specimens are met with in the near neighbourhood of palaces, noblemen and gentlemen's country-seats, and dotted over the hedge-rows belonging to these residences. Sometimes we see them shading the old manor-house, or sheltering the farm homestead, formerly the abode of the wealthy yeoman, though now of a tenant who cares nothing about trees.

Elm timber is less durable than oak, either standing or after being converted to use. The tree arrives at a great height with proportionate diameter of stem; but after three or four score years, especially on light soils, the bole begins to decay at the heart, and which decay proceeds rapidly outwards till the trunk becomes a mere shell, in which state it will, however, live and be increased in diameter for many years, although quite hollow within.

This species is a very ornamental tree in all its stages, more especially after it has acquired its natural character and specific habit, and the older it is the more picturesque it becomes. When planted for

profit it should be felled as soon as a load (fifty cubic feet) or a load and a half of timber is computed to be in the bole. Better it is to fell a few years too soon than one too late. One invaluable property of the English elm is its tendency to stool, that is, to produce suckers from the root, which fully compensates for its want of seed. Where once a tree is planted, particularly in hedge-rows, there it and its young progeny will ever remain. And it is no uncommon case that the same hedge-row has been felled from by the grandfather, father, and son, and yet the last cannot perceive any diminution in the number of his trees.

This tree is best propagated by layers. It is sometimes grafted on the common or witch elm; but this is a bad practice, because there can be no succession of suckers of the right sort.

Middlesex is famous for hedge-row elms; and there the trees are most unmercifully shredded, that is, trimmed up and divested of all their side branches except a few at the top. This, though it causes the timber to be of a knotty unwedgable character, is apt to induce internal decay from the numerous wounds inflicted on the surface, some of which, if not quickly healed over, admit moisture which penetrates to the centre, or allows a discharge of sap, a defect to which the elm is very subject.

There are several other species of elm, natives of Britain and North America. The witch elm, a very common sort, is of a more rambling growth than the first, but the timber is less esteemed, though very useful for many purposes in rural buildings and implements. The cork-barked and Dutch elms are admitted into our plantations for the sake of variety only. The leaves are an ingredient in the "British herb" tea, so much of which was lately condemned and burnt by order of the commissioners of customs. The inner bark of the elm, like that of many other trees, has been, in times of scarcity, and still is commonly in the northern parts of Europe, ground into powder and mixed with meal to make a coarse kind of bread. The leaves form a good nourishing kind of fodder, and in many parts of this island they are given to cattle.

ELYMUS (Linnæus). A genus belonging to the natural order *Gramineæ*, containing above twenty species, most of which are found in the northern hemisphere. Three of them are common in England, and called lyme-grass. One of them, *E. arenarius*, is cultivated on the sea-coast for fixing drifting sands.

ELYSIA (Risso). A genus of mollusks established by Risso, and inhabiting the Mediterranean, but too imperfectly known to be at present depended upon from his description, and probably referable to some genus already accurately described.

EMARGINULA—Lamarck; **PATELLA FISSURA**, Linnæus. Lamarck has constituted this genus of molluscs from the confused genus of the Linnæan patella. This shell is conical, more or less elevated, and inclined to the anterior side, which is always the least, and, opposite to the slit or fissure, elegantly cancellated with longitudinal ribs and transverse striæ, a deep and narrow marginal fissure extending nearly half-way to the summit; the interior, with a muscular horse-shoe impression, opens backwards, and is thicker at its origin. Most of the shells of this genus are very small, some are of an elevated, and others of a widely depressed conical form. Lamarck only enumerates two species, but more are now known. The animal

has an oval body, the mantle furnished with very delicate tentacula, placed round its circumference; slit more or less deep at the front part, for the communication with a very large bronchial cavity, in which the branchiæ are distinctly visible. Taking the marginal fissure and its position with regard to the other parts of the shell, very distinct species may be distinguished; but it is scarcely necessary to enumerate them in this place, as they would only interest those naturalists who seek more deeply for minute distinctions than the generality of our readers are supposed to require. These shells belong to the second class *Paracephalophora*, second order *Cervicobranchiata*, first family *Retifera*.

EMBERIZA—Bunting. A very numerous genus of birds, belonging to Cuvier's great order, *Passeres*, and to the *Conirostral*, or cone-shape billed division of that order, of which, in as far as the form of the bill is concerned, they are very typical. This genus has been extended by some authors to include a vast number of birds, especially foreign birds, which from time to time were imported in single specimens, unaccompanied by any descriptions of their habit, and named without much regard to the proper distinctions of the buntings. Many of these, more especially the American ones, have been so well described, and are so popularly known as buntings, that we shall retain them, although *strict* regularity of system would justify our describing them under other names.



Bunting.

The general characters of this genus are these: bill very strong, short, straight, conical, compressed in the sides, firm in the cutting edges, but without any tooth or notch. The upper mandible narrower than the under one, turned inward at the edges, and with a hard or horny knob at the palatal end. It is in this bill that the true character of the bunting consists; and every bird which has such a bill may be regarded as a bunting, whatever may be its other characters. This bill is well fitted for the breaking of shells or the rinds of seeds, and ejecting them without losing any of the farinaceous kernel, which, from the way that the mandibles close, drops into the bill rather than out of it. The wings are moderately long, the second and third feathers being the longest, the tail forked or lobed, and spreading out towards the

extremity. The feet, with three toes before and one behind, all free. The resident species have their claws short and hooked, and adapted for perching on trees, and also on the culms and stems of those herbaceous plants from which they pick the seeds. This genus live chiefly upon seeds, and consume a vast quantity, seeking them indiscriminately upon the plants that produce them, or on the ground; but they likewise eat insects. The snow-bunting runs on the ground, but does not perch. It has the claw, as in the larks, with the hinder toe produced, or rather intermediate between the larks and the other buntings. This genus of birds have plenty of voice, but no song; and as their vegetable food is better seen in clear light, during the heat of the day, they are always active, and incessantly keep up a harsh and tuneless clattering. The air of these birds is heavy, and they are careless, and very easily snared by the fowler. In the autumn they get very fat, and the flesh of some of them is highly prized. The common bunting has rather a sober plumage; but the others are equally remarkable for the richness of their tints and the beauty of their contrasts. Their want of song prevents them, however, from being sought after for the cage, so that they are neglected, and persecuted as creatures formed merely for destroying or being destroyed. It is true, that where small seeds are sown and cultivated, the buntings commit considerable ravages; and they likewise consume a portion of the corn, especially of any patches that get ripe before other parts of the field; but during the rest of the year they are of considerable service in consuming the seeds of the larger weeds which grow in the fields, such as corn-marigold, ragwort, and other pests of thin and badly-cultivated soils, though they are not very welcome visitants in the garden. When seed time and harvest are blended together throughout the year, and seeds are sown at all seasons, the wild birds, which remain true to the seasons, while man forees his cultivation against them, are in so far mischievous; but in places where there are only seasonal crops, that is not so much the case. The time at which the granivorous birds are undergoing their moult is when the crops are or should be ripe; and as the smaller seeds are preferred by all the little birds to grain, and of course stubble lands to those which have standing crops, against the time that they congregate in flocks there should be always stubble for them.

THE YELLOW BUNTING (*Emberiza citrinella*), Yellow Bunting, Yellow Hammer, or Yellow Yowley.—This species has the tail-feathers blackish, the two outer ones on the inner webs marked with one acute white spot. The weight of the yellow bunting is, in ordinary, about seven drachms, the length six inches three lines, and the extent of its wing nine inches two lines. It is an inhabitant of Europe from its southernmost point, at least as far north as Soudmor, and it is likewise found in the west of Siberia. In this and many other countries it is of very common occurrence. Its song is as little attractive as that of the common bunting, consisting merely in a repetition of the same note five or six times, and terminating in a more lengthened and shrill one. But, besides their native note, it has two particular calls, the one that of rallying, which it in common utters when flying, and during summer on the approach of evening; and the other expressive of its uneasiness when alarmed or offended, especially when any one goes near its nest or little ones. Many of them are supposed to travel

southward during the autumn; but those which remain congregate in winter, mingling with chaffinches, sparrows, and many other small birds, approaching houses in the day time, or even towns, or frequenting highways, picking up little grains, and extracting them from horses' dung. This combination of different species, intent on catering, only lasts during the day; for some hours before nightfall the family separate, and retire to their respective haunts, the buntings previously perching on the tops of trees, from which they do not descend till after sunset. The male, from this elevation, pours forth his note in the season of love, sometimes for hours together, remaining without changing its position. During the spring and summer months, they frequent hedges and copses, but very seldom the interior of forests. They alight very suddenly from their flight, which is very rapid, and for the most part amidst thick foliage. The female bunting does not breed till late in the spring, and yet has two, and occasionally three, hatches in the course of the season. The nest, which is large and flat, and rather simply composed, is generally placed near the ground, sometimes under a clod, but more frequently in some low bush or hedge, and consists of straw and various dried stalks, lined with fine grass and long hair. The eggs vary in respect of colour and size, some being nearly white, and others having a purplish hue, but all more or less marked with hair-like streaks, and terminating with a roundish speck; and their number varies from three to five. The female incubates with such ardent attachment, that she may frequently be caught by the hand. During the short period she is absent in search of food, the male takes her place in the nest. The young are fed with small seeds and insects. These birds in captivity will live for six or seven years, and even longer; but they are liable to epilepsy; and their music is too little engaging to repay the trouble of rearing them. Where small birds are used for the table, as almost every description of them are in Italy, the yellow bunting is frequently fattened for the market. In flavour it very much resembles the lark.

The yellow hammer is one of the most common of British birds, and it is also one of the most beautiful; but somehow or other it is not a favourite; and, in very many parts of the country, the boys seek its destruction as a meritorious work.

THE COMMON BUNTING, or CORN BUNTING (*E. miliaris*), is more a bird of the cornfields and hedges, and less of the copses than the yellow bunting; and is considered, perhaps unjustly, as a great enemy to the farmer. This species is found throughout Europe and the northern countries of Asia, is not distinguished either for its song or the beauty of its colours, and has not so good a title to be admitted into the house as the preceding. It has a very similar plumage to that of the skylark, but surpasses it in size, being seven inches and a half in length, of which the tail measures three. The beak, measuring six lines, is strong, yellowish on the under part in the summer; and grey brown during the rest of the year; the feet, which stand six lines in height, the same. The general tint of the plumage is pale, reddish grey on the upper part of the body, and yellowish white on the under, speckled like the lark's with blackish brown spots, broader on the back and narrower on the belly. The quill-feathers are dark-coloured, as also the tail-feathers; the outer ones have a wedge-shaped but indistinct spot of white.

On many parts of continental Europe, the common bunting is a migrant ; but in most parts of the British islands it is resident the whole year, though it flocks upon the lower fields during the winter, and lives more dispersedly in the breeding season. In the Shetland Islands, it appears in small flocks as a migrant during the winter ; but as the spring sets in, and the nesting time approaches, it entirely leaves those islands, and is not found upon them again during the summer and autumn. It evinces a preference to champaign countries that abound in corn and meadows, being very rarely found in uncultivated tracts, or even in grass fields that are far from arable land. It may frequently be seen on the highest part of a hedge, or uppermost branch of a tree, uttering its dissonant and harsh cry, which it repeats at short intervals. These birds in this situation may be seen and heard during the greater part of summer, after which they may be met with in flocks, and continue so during the greater part of winter. At the time the female is busied with incubation, the male sits on a neighbouring tree, and cheers her with his rude song, taking her place occasionally at noon, when she is said also to sing, perched in her turn. The nest is placed among tall herbage, on the ground, or else in a very low shrub, about four or five inches above the surface of the soil, formed externally of straw, lined with fibrous roots, or dry grass, and occasionally finished with wool or long hair. There are from four to six eggs, of a dirty white, spotted and veined with reddish-brown and ash-colour. The young quit the nest before they can fly, being fond of running on the ground, and the parents continue to guard and feed them till they are fledged ; but they not unfrequently betray them from their anxiety for the safety of the brood ; and if a person happens to approach near the spot, they wheel round his head in a doleful manner. They are sometimes brought into the market and sold for larks, and, as an article of food, are not inferior to them, but they may easily be distinguished by the form of the bill and the tooth-like knob which they have on the palate. The fat birds are reckoned a great delicacy, but when they get old they are lean, dry, and very tough. They are fattened in Rome in the same manner as the millet. They are used by the bird-catchers in the autumn as call-birds, and they not only entice the foolish buntings into the snare, but different kinds of small birds ; and they are put into low cages without bars or roosts for this purpose. As this species of bunting feeds its young, in great part at least, upon caterpillars, and as its winter food consists, in part, of the seeds of those plants which are most troublesome to the farmer as weeds, it is to be regarded as a serviceable bird, and not as a destroyer.

THE FOOLISH BUNTING (*E. Cía*). This species gets its name from the readiness with which it comes at the call of any other of the genus, more especially the yellow hammer, and the disposition which it has to go into any sort of trap or snare. In appearance it bears some resemblance to the common bunting, but it does not inhabit either exactly the same countries or the same districts. It is found in summer in the mountainous parts of southern Europe ; and although it descends to the plains, and ranges at least as far as the middle of Germany in the winter, it is rarely seen near the coasts, and never, we believe, in the British islands. In size it is inferior to the yellow hammer being only six inches long, of which the

tail measures two and a half ; the beak, five lines in length, is very sharp, blackish above, and of a greyish colour below ; the iris is dusky ; the legs are nine lines in height, and of a brownish flesh-colour. The head is grey, spotted with red, having small black streaks on the top, and an indistinct black line on the sides. The cheeks are light ash-colour ; a dusky white streak passes from the nostrils above the eyes, a black one crosses them, and uniting with a third that springs from the under angle of the beak, encircles the cheeks ; the back is reddish brown, speckled with black, the rump light red brown ; the throat pale ash-colour, the under part of the neck, to the middle of the breast, grey, the rest of the under part of the body red, but the belly is somewhat lighter ; the small wing-coverts are dark grey, the others are black ; the anterior quill-feathers are edged with a reddish colour, the others, with the lowest row of the coverts, are red ; the second row of the coverts have their points reddish white, which form a band of this colour on the wings ; the tail, rather forked, is black, the two outer feathers have a wedge-shaped white spot on the inner base, the two middle ones are bordered and tipped with deep red. In this species, the female does not differ very greatly from the male : in her the head is of a grey colour, with black spots, and a reddish tint ; the streaks are much less conspicuous than in the male ; the ash-colour on the throat has a reddish tinge, and is streaked with dusky black ; and the whole of the under part is paler in the colour.

In the summer they disappear entirely from the low and cultivated grounds, and are found only in wild and upland places, though there they are inhabitants of the open waters, and not of the wooded districts. They do not quit the low country till March or April, so that it is probable that they have only one brood in the year, whereas those which nestle in richer places have, in general, if not invariably, two.

THE REED BUNTING (*Emberiza Schœniclus*). This bird is nearly the size of the mountain sparrow, and is sometimes, though very improperly, called the "reed sparrow." It has been confounded by authors, if not by observers, with another bird, to which it has little or no other resemblance than their both inhabiting the same places. In their structure, their habits, their nests, their eggs, and even in the purpose that takes them to the thickly matted aquatic plants, these birds are entirely different. The one is a genuine warbler, having a melodious and varied, though feeble song ; as such it feeds upon insects, resorts to the aquatic plants for them, and does not quit the country till the supply fails. The bird under consideration is a genuine bunting, resident, like the other short-clawed buntings, among tall herbage, of which it eats the seeds, and hence it is found only where graminiferous plants grow ; while the warbler, makes merely its dwelling in the herbage, but does not feed on any part of it. It is found among all the tall aquatic plants, though mostly among ridges and reeds, as these form the thickest matting in the shallows and margins of the waters. The bunting is much the larger bird of the two, nearly equal in size to the yellow bunting, and double the weight, at least, of the sedge warbler. The bunting's nest is very seldom placed in the reeds, but mostly near, though it is occasionally at a considerable distance, in a tuft or under a low bush ; and when it is among reeds, it is placed where they form a dry tuft or other support, and never suspended to them by a basket-work of leaves, like

that of the warbler. The eggs of the bunting are greyish white, and not quite so numerous; they have a tinge of pale pink in them, and are lined and spotted with chocolate red, like the eggs of the other buntings; and those of the warbler are pale brown, mottled with darker, and without lines. The reed bunting is as destitute of any thing that can be called song as the rest of the bunting genus; and the sound which it utters, such as it is, is delivered in daylight, and while the bird is perching in sight of the observer. The reed warbler on the other hand has a sweet though subdued note, and it sings, in "shadiest covert hid," only at early morn, or in the evening twilight, and sometimes the live-long night.

The appearance of this species may be thus described: length, about five inches and three quarters, of which the tail occupies two and a half; the beak, four lines in length, is black on the upper part, and whitish on the under; the iris is dark brown, the legs rather better than nine lines high, are dark flesh-coloured. The head is black, with reddish spots; a reddish white line extends from the base of the lower mandible quite round the head; it is widest at the cheeks, and narrowest at the upper part of the neck; this part is ash-coloured; the back is black, spotted with white and red, the rump alternately grey and reddish yellow; the throat is black spotted; the rest of the under part of the body is dusky white, with some brown spots scattered over the breast and sides; the small wing-coverts are red, the large black with red edges, in some they are whitish; the pen feathers are dark brown, bordered with pale red; the tail is forked, and of a dusky colour; the two outer feathers have a large wedge-shaped white spot, and the two middle ones yellowish brown borders. The feathers on the head of the male never turn to so good a black after moulting, when in the house, as in the wild state, but are always browner and clouded with reddish white. The head of the female is of a rusty brown, spotted with black; her brown cheeks are encircled with a reddish white streak, which, passing above the eyes, unites with another, which commences at the base of the beak; a dark streak passes down the sides of the throat, which, with the under part of the body, is reddish white, much streaked on the breast with light brown; the colour of the back is lighter, but not so clear as that of the male.

It is probable that buntings, and indeed all birds that feed upon the farinaceous portions of seeds, in the healthy state, are chiefly guided to their food by sight. There is but very little scent in those seeds on which buntings feed, and we do not know much about the sense of smell in birds; most birds appear to us to have the sense of smell very imperfect, and in those which have it very acute, as rooks, carrion crows, magpies, and especially vultures, it is so much more exquisite than any thing of which we have experience in ourselves, that we can say little or nothing about it. The vegetable seed gives no signs of its presence by motion, either in producing sound, or in any other way; and, therefore, sight is the sense that they must depend upon chiefly. With birds that are insectivorous it is different, for most insects and their larvæ smell, and some of them smell very strong: and many of those caterpillars which are quiescent during the day, concealed or sticking out from the branches like little abortive or unproductive twigs, are in active motion during the night. Thus the hours of activity in the two orders of birds vary considerably; and though,

as all of them eat insects, and most of them vegetable matter occasionally, they meet on the confines in a sort of average of the two habits, yet, in the more marked genera of the orders, the times of feeding are almost reversed. In the clear light, during the dry weather, when the seeds are ripening apace, the buntings are all bustle, activity, and clatter, and the warblers are songless in the shade. On the other hand, when night sets in, or when the weather continues wet, and the sky cloudy, the buntings chirp dolefully about the hedges; but the groves and thickets are full of joy and song. The skylark is something intermediate, and is fondest of that weather which first inspired him with song,—showering and shining alternately. The reed-buntings are very energetic in the air, and active in many of their motions, especially those of the tail, which are even more rapid than in the wagtails. The tail is forked at the extremity, and considerably produced and spread. The habit which the bird has of clinging to the flexible culms of the aquatic plants, with free use of its bill, so that it may bruise the husks and pick out the seeds, renders the powerful and ready motion of the tail as a means of balancing, absolutely necessary. The security and even the grace with which it rides, when the stems are laid almost level with the water, now on one side and then on another, are well worthy of notice. It adheres not only as if it were part of the plant, but it contrives to maintain nearly the same horizontal position, with its head to the wind. In action it is the most interesting bird that inhabits the same locality, though not so in song. When the autumnal winds and those of early winter have shaken off the seeds, and the reeds themselves have been borne down by the floods, the reed bunting resorts to other pastures, associating with the yellow bunting and the other graminivorous birds; and in company with them approaching houses and farm-yards, when the weather is severe. With few exceptions, indeed, the resident little birds seek the abodes of man in the winter, and as instinctively come to pick up the crumbs and grains which otherwise would be lost near his habitation, as they resort to other places, and destroy insects and weeds in aid of his cultivation during the summer. In autumn they enter the area or decoy with the chaffinch; in spring, when there is snow, they approach the barns and dunghills, and there, as well as in the open fields, and on the hedges, they are very easily taken with birdlime or a net.

THE SPARROW BUNTING (*E. passerina*). This species must have been confounded by naturalists with the preceding, or it would have certainly been better known, as it is not rare either in spring or autumn. It is a more slender and smaller bird than the former, being only five inches long, of which the tail measures two and a quarter; the bill is light brown below and black above; the iris is of a dark chestnut colour; the feet are three-quarters of an inch in height and dusky flesh-coloured; but the plumage in general is similar to that of the female of the preceding species. The male bird has the top of the head red, with a grey longitudinal streak in the middle, and many black spots arising from the deeper shade of the feathers, which appears in every direction: a dusky reddish white line passes from the nostrils above, and also a little under the eyes, and widening behind on the temples, chestnut-brown breaks through a deep black, which reaches the sides

of the neck, and becomes a spot there; a yellowish white line passes from the under angle of the bill down each side of the neck to the middle, and is lost behind the temples with that which passes by the eyes; the throat is black clouded with pale grey, like the house-sparrow; the rest of the under part of the body is greyish white, speckled on the sides with dark chestnut, but the under tail coverts are pure white; the sides of the neck and upper part are grey-olive, spotted with black, the rump is also the same colour, with a reddish tint; the small wing-coverts are a fine red, the others have only a wide border of that colour, the rest being black. The quill-feathers are blackish, edged with olive-grey, the last with red; the forked tail is black, the two outer feathers have a wedge-shaped white spot, and the two middle ones are edged with red. In the female there does not appear any black on the top of the head, as in the male, and the colours are in general lighter; a reddish white streak passes above the eyes, another descends down the sides of the neck from the base of the beak, a third, but of a dusky black, extends from each side of the chin to beyond the middle of the neck; the throat is a dusky reddish white, the under part of the body the same colour, but continues to become paler to the under part of the tail; the breast and sides are streaked with a red brown; the nape and back of the neck are reddish grey; the back is longitudinally spotted with black and reddish grey. When kept in the house the black disappears from the head of the male, and the upper part of the neck changes to greyish white, spotted lengthwise with dusky black.

The favourite haunts of the sparrow-bunting are in a mountainous country, where there are thick woods and bushes. It is a bird of passage, which comes some time in April and quits us in the latter end of October or beginning of November. Its food is grain of all kinds, and insects, when in the wild state; but in the house it is fed on the same food as the reed bunting; and resembles that bird very much in its habits and song; and may be taken with either the net or birdlime. It is probable that this is only an accidental variety; and the same may be said of the provincial bunting and some others which have been named and described by authors.

THE CIRL BUNTING (*E. cirrus*). This species is varied in colour above, and yellow beneath, and the two outer tail feathers are marked with a white spot wedge shaped. The ciril bunting is six inches and a half in length. Is a native of Italy, France, and the other warm countries of Europe, frequenting newly ploughed fields, feeding on grains, insects, and worms, which last it pulls out of the ground. Though not uncommon in many parts of Cornwall and Devonshire, it was first recognised as appertaining to the British fauna by colonel Montagu, who met with it among flocks of yellow buntings and chaffinches. It generally builds its nest in furze or on some low bush, and is composed of dry stalks, roots, and a little moss, and lined with long hair and fibrous roots. The eggs are four or five in number, cinereous white, with irregular long and short curved lines, frequently terminated with a spot at one end. They pair in April, and begin laying in the early part of May. At a little distance the females might readily be mistaken for the same sex of the yellow bunting, but are obviously different when closely compared. The note of this species is also similar to that of the yellow bunting, but shorter, less shrill, and the final part not

drawn out to such a length. The female has only a gentle plaintive chirp. The principal food of the young bird appears to be insects, especially grasshoppers; and they will likewise eat various seeds, canary being a great favourite. They can be tamed very easily, and will live six or seven years in confinement.

The colours of the ciril bunting may be thus described. In the male bird, the bill is bluish above and pale on the under part; the irides are hazel brown; a streak across the eye, and the throat greenish black, with a bright yellow streak above and a paler one below it; gorget pale yellow; the lower part of the breast and sides of the neck pale olive green, with a soft tinge of grey, passing into pale yellow on the belly, and again into mottled tints of reddish or orange on the sides; the centres of the feathers on the head blackish, those on the scapulars reddish orange, passing into blackish brown on the back, and again into reddish brown on the rump; the darker ones margined with grey, the orange with yellowish white, and the red with greyish white; quills greenish grey, with pale yellow margins; the outer feathers of the tail with white webs on the basal half; other feathers blackish, margined with yellowish grey the feet are brown, tinged with red. The top of the head of the female is dull olive green; the chin, where the dusk is in the male, pale brown, with darker streaks; the flanks streaked with brown where they are mottled with reddish orange in the male; the female is rather less, and the colours are in general less pure and bright.

As these birds fly much in company with the yellow buntings in winter, they might be looked for in warmer places, a little farther to the north than they have hitherto been found; though, as they are in a great measure corn-land birds in their habits, the sheep walks on the southern heights may impede their progress to the countries farther to the north, and they cannot be expected on the mountains.

THE ORTOLAN (*E. hortulana*). This is a true bunting, and considered as a luxury for the table; it is among the most celebrated of the whole. It is necessary to be somewhat exact in the description of this species (which, by the way, is rare as a British one, and can be considered only as a straggler), because not only the bird-catchers in those countries where it is much in request, but even some naturalists, are apt to confound it with other species. The true ortolan has a wider breast and stronger beak than the yellowhammer; it is six inches and a half in length, of which the tail measures two and a half; the beak, six lines long, is thick at the base, with a bony tubercle at the palate, and is of a yellowish flesh colour; the iris dark brown; the legs, which stand rather more than three quarters of an inch in height, are flesh-coloured; the head and neck is greyish olive; the throat, and a streak on the neck, from the angle of the beak, deep yellow; the back and the feathers of the scapulars chestnut brown, speckled with black; the rump of a dirty grey brown; the under part of the body reddish yellow, waved with light brown; the quill feathers are dark brown, with a red border to some and a grey to others; the tail feathers dark, the two outer ones with a wedge-shaped spot, the others with a red border. The female is rather smaller than the male, of a changeable shining ash-colour on its head, and its neck streaked with fine black lines; its breast, and the upper part of its body,

are lighter coloured. The throat of the young male birds, before they have done moulting, is of a light yellow, with a mixture of grey; the breast and belly are of a reddish yellow, speckled with grey, which make them rather resemble young yellowhammers. A bird-fancier will distinguish the two sexes even in the nest. There are white, yellow, speckled, and in the house sometimes even black varieties.

Though this bird is not found in Great Britain, it occurs in many parts of Europe, as Italy, France, Germany, and even Sweden, migrating in spring and autumn, when great quantities of them are caught, and fattened for the market, being proverbially celebrated for the delicacy of their flavour. That they may more speedily acquire the requisite degree of plumpness, they are shut up in a room, from which the external light is excluded, but in which are placed a few lanterns, to enable them to see to run about, and pick up the millet and oats that are regularly strewed on the floor. Under this regimen they soon get so fat, that they would speedily die if not removed by the dealers. It is pretended that those from the plains of Toulouse are superior to those of Italy. In some districts of the latter country, where they are plentiful, as, for example, in Lombardy, they are not only prepared for the table but trained to sing; and Saserne observes, that there is considerable sweetness in their song. If allowed to associate, especially when young, with other birds, they adopt some of their notes. The female makes her nest in a low hedge, or a vine, or on the ground, especially among corn, composing it carelessly of plants, mixed with leaves and dry or green rushes. She lays four or five greyish eggs, with a very pale tinge of purple, and sprinkled with very small blackish spots. They generally have two broods in the year.

In spring these birds are easily attracted to a decoy bush by a female of their own species; or a yellowhammer. In August a turfy place should be chosen near brambles to form a small area as a decoy, like that made for chaffinches. It must be surrounded with a low hedge, with some oat ears fastened to it. About the area should be placed one or several call birds, especially a perching bird; that is to say, a bird of the same species, with a band of soft leather round it, and confined by a small string fastened to a peg-stick in the ground, which prevents its going beyond the limits prescribed. Then it should be given plenty of food and water, in order that the birds to be caught may be the more easily attracted within the area, from seeing one of their own species in a place of abundance. This kind of decoy bird is often more necessary than any other.

The fine form and colours of the ortolan would be quite sufficient to render it desirable, but still more so its melodious flute-like warbling, so clear and full, which has some resemblance to that of the yellowhammer, only that the last notes are much deeper.

THE SNOW BUNTING (*E. nivalis*). This bird is known by many popular names, such as the "snow bunting," "snow flake," and "snow bird," and has been sadly in the way of those who do not combine a little knowledge of the principles of ornithology with the mere observation of individual birds. It has got several trivial names expressive of differences of colour; and it has been specifically called a lark, and also a finch. In reality this is a polar bird, and inhabits the arctic zone in both continents, and though not a mountain top bird, like our ptarmigan, yet

subject, from the higher latitudes of which it is a native, to greater extremes of seasons than that, it is also subject to similar changes in its plumage. And further, though it does not migrate very far to the southward, it is a wandering bird; it does not change its plumage so regularly or so completely as the flocks that migrate, as the ptarmigan which summer and winter in the same places do, upon the tops of the mountains, even of the comparatively low latitude.

There is something in this well worthy the attention of those who wish to study the adaptation of animals to those circumstances in which they are placed; and if this is not attended to, we name and describe the species, and arrange them into systems, to very little purpose. The mountaineer, whether it be bird or any thing else, does not quit its mountains, or at all events it does not range to a very great distance from them, or wholly quit the country in which they are situated; and this holds true of man as well as of the other animals. It matters not what may be the part of the world, for if we are any where to find the aborigines, we must seek for them in the mountains. In the Pyrennees, the Alps, the Caucasus, and in short every lofty ridge that we can name, we find people who have outlived all the changes on the plains. While too the animals of the low lying places are driven before the weather, the mountaineers keep their ground, and, to enable them to do so, they of course are much more changed, especially in their covering, than animals which, from their migratory habits, are able to endure the milder climates into which they migrate, without those seasonal adaptations.

When the violence of the polar winter sets in, it of course whelms the pastures of these birds completely under snow. They are, however, very irregular in the periods at which they come on in different years, and also in their violence. Of course the snow buntings do not leave their native north until the winter comes, that is, till the snow comes, for the clear black frost often continues for a considerable time before the heavy falls of snow. In consequence of this, the snow buntings appear in the more southerly parts of their range, in very different plumages, according as they come earlier or later, and this seems to be the chief reason why they have got so many names, such as the tawny bunting, the pied finch, the white lark, and several others.

In the summer these birds inhabit the rocks and peat-covered tracks of the extreme north, where they subsist upon the seeds of rushes and other hardy plants; and the produced claws on the hind toes enable them to run on the soft or moss-covered surfaces with more facility than they could do if these appendages were short; but in proportion as this structure fits them for walking upon these surfaces, it disqualifies them for perching upon trees. But there are few or no trees in their native country; and when they migrate to the south, they are ground birds rather than perchers.

When they appear upon our shores, they prefer those places which are most of a polar character; they do not affect the woodlands, neither do they resort to the neighbourhood of houses, or even to the cultivated fields, as is the case with our native birds in the winter. They linger on the cold moors or their margins, and as such places are not very tempting in the season of snow-buntings, it is probable that few are seen in proportion to the numbers which visit

the more inhospitable parts of the country. If, however, these are covered up with snow, the birds are driven to the trodden places; and the snow-bunting, among the rest, comes in for a share of the droppings of horses, which form a chief source of supply to the birds when the ground is covered. The young of early broods are the first to appear; they are more brown in the colour, have the bill yellower, and are smaller in size than the mature birds, and hence they have been described as a separate species.

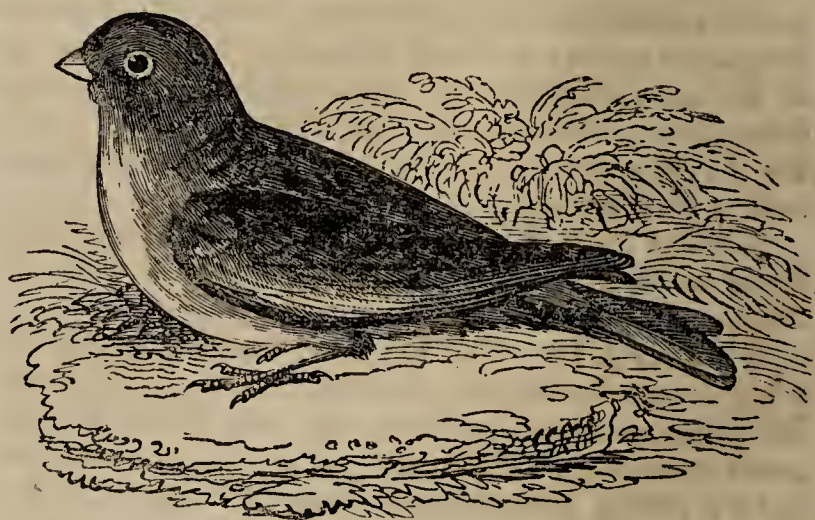
When very severe snow storms occur at a late period of the winter, the full-grown males sometimes come to Britain in great numbers, and with their winter plumage nearly perfect. They are then pure white, with the exception of a portion of the back, the middle coverts of the wings, and some of the tail feathers and the quills, which remain black. It is in this state that they are called pied finches, or snow flakes. The last of these names is very appropriate; for although most winter birds come before the storm, they are often taken by it on their way, and arrive exhausted amid the driving snow, when many of them perish.

Norway, or at least some part of the country to the north of the Baltic, is probably the country from which they generally come to Britain. Their natural flight is in all probability to the south, and the continent of Europe the place on which they would land if they kept their direction. But as the length of the parallel, and with that the falling behind the rotatory motion of the earth, increases, they are turned to the westward in the very same way that the storm is; and thus though the unequal motion both of snow flakes and of snow is from the north, they really come from the north-east, the motion of the storm giving additional obliquity to that of the birds.

The best account of their appearance in Germany (they do not reach the more southerly parts of the continent), is that given by Bechstein. "When the winter is severe," says he, "these birds are seen from December to May, in many parts of Germany, where they even approach the villages. I am persuaded that, if attention were paid to them, they might be seen in every direction during March, on their passage to the north; whilst the snow is on the ground they are found in company with larks, on the high roads and in the fields, they may then be taken with horse-dung placed in a net, or covered with birdlime, or by clearing a spot of ground of snow, and strewing it with oats. I have had a pair in my room six years without a cage, and they are satisfied with food common for other birds; if kept in a cage, they must be fed on hemp-seed, oats, millet, rape, and poppy seeds. They appear much delighted whilst bathing: during the night they seem very uneasy, hopping and running about continually. Their strong and piercing cry resembles a loud whistle; their song would be rather agreeable were it not interrupted in a peculiar manner; it is a warbling mingled with some high noisy notes, descending slowly from shrill to deep, and a little strong and broken whistling. Heat is so contrary to their nature, that they cannot be preserved unless carefully guarded from it.

As the winter sets in, large flocks of these birds proceed from the north of the Baltic and distribute themselves over the low country in Poland; but in that longitude their migration extends not further than the Carpathian mountains; and they begin to disappear on their return to the north in February

and March. On the American continent they do not advance farther to the south than the state of Virginia. The numbers of them that assemble in the north during the summer season are immense, so much so, as to give a character even to the remotest countries which have been visited. Countless thousands are found on the ice near Spitzbergen: and there are numbers also in Greenland. They breed in the fissures of the rocks. As already hinted, numbers of them frequent the north of Scotland, and some of them are even understood to breed there; and in the Orkney islands they are especially numerous. They are not unknown in England, though we believe they seldom come further to the south than Yorkshire. After their long flights, they are usually much exhausted, but they soon recover and get very fat; in which condition they are styled ortolans of the north. They are inferior in size, and perhaps also in flavour to the genuine ortolans of the south; but still, from their numbers, as well as their quality, they form a valuable addition to the food of the northern people. Their appearance in the British islands is supposed to betoken a severe winter, or heavy falls of snow. These birds do not perch, but continue on the ground, and run about like larks, which they also resemble in size, and in the length of their hind claws, and by some authors they have been accordingly ranged with that family; but, from the peculiar structure of their bill, they are now, with more propriety, referred to the tribe of buntings. They sleep little during the night and are very wakeful, and, in the months of June and July, begin to hop about with the earliest dawn. The male sings feebly during the breeding season; his call note is more agreeable, but that of alarm or anxiety is, on the contrary, loud and shrill. He sings from the beginning of May till the end of July, and often during the night, which they always pass on the ground. The female builds in the crevices of rocks, constructing a nest of grass and feathers, lined with the hair and wool of the arctic fox, or other quadruped, and laying five or six reddish white eggs, spotted with brown, and nearly spherical. The male assists in the duty of incubation.



Snow-flake.

The snow bunting is nearly of the same size as the lark, six inches and a half in length, of which the tail measures two inches and two thirds. The beak is half an inch in length, with every characteristic of the bunting species, of a conical form, rather bent at the sides, and having a bony tubercle like a grain of barley at the palate; its colour in the singing season is entirely black, at other times the point alone is black, the

rest yellow. The legs, which stand an inch high, are black. The neck and all the under part of the body are white, and the head is white spotted with brown. The back and rump are black, with pale margins to the feathers. The quills are white for half their length from their base, and black in the one web for the rest of their length. The tail is forked with three of the lateral feathers on each side white, with a black spot on the tip, and the next four black with a yellow border. The female is smaller and browner in the colour. The male, in the breeding season gets considerably blacker than is stated in the above description; and, indeed, there are few birds of whose colours it is more difficult to give an account that will apply to all the individuals, or even to one individual at all seasons.

THE LARK-HEELED BUNTING (*E. calcarata*). This species is named from the great length of the claws on the hind toes, which are nearly as much produced in proportion as those on the lark. It is about the same size as the former, or perhaps a very little larger; and it is an inhabitant of the same countries, but of places more inland and mountainous, so that it is less of an emigrant. On the continent it goes occasionally more southward during very severe weather, and we believe it has been observed in Britain, but only as an occasionally rare straggler. Its habits are very little known. The general colour on the upper part is fawn spotted with black; and the throat and upper part of the breast are black in the male during the breeding season; but in winter the black breaks into streaks, something similar to those in the female, but darker and better defined.

Very many birds besides those which we have enumerated, have been described by various authors as buntings, and of these not a few are more allied to the linnets. They are in general inhabitants of the warmer parts of the world, and too little is known of their habits in a state of nature for enabling us to class them with anything like accuracy.

EMBLICA (Gærtner). A genus of shrubs, natives of the East Indies. Linnæan class and order *Monœcia* *Monadelphia*, and natural order *Euphorbiaceæ*. Generic character: flowers monœcious; calyx six-cleft; stamen, filaments single, filiform, long, trifid at top; anthers attached by the back and with the filaments forming a point; styles three, united at the base, split at the apex into several recurved divisions; capsule drupaceous, three berried, each two-seeded. This is the *Phyllanthus emblica* of Linnæus, and the *Nymphanthus* of Lourino.

EMBO'THRIUM (Forster). An ornamental shrub found in New Holland, belonging to the natural order *Proteaceæ*.

EMERALD. This precious stone has long held a high place for its colour and brilliancy, and there are few mineralogical cabinets that are without specimens from Peru and Brazil. The emerald and beryl have a strong resemblance to each other: thus both are green, their crystallisations differ but little, and in point of fracture, hardness, and weight, they are nearly the same. Notwithstanding these agreements, they are readily distinguished from each other by the following characters. The emerald occurs only of a green colour, but beryl, besides green, is also yellow and blue; the crystals of beryl are long, those of the emerald are short; the lateral planes of the beryl are streaked, those of the emerald are almost always

smooth; the terminal planes of beryl are smooth, those of the emerald are rough; and beryl is rather softer than the emerald.

Many of the emeralds described by the ancients appear to have been varieties of green fluor spar. Even in more modern times, green fluor spar has been preserved for emerald. Mr. Coxe examined the celebrated emerald table in the abbey of Reichenau, near Constance, which he found to be a very fine green-coloured fluor spar. The celebrated *sacro cattino di emeraldo orientale*, preserved at Genoa, is in reality but a mass of cellular glass. Many of the fine Ethiopian emeralds, which were bequeathed to monasteries, appear to have been sold by the monks, and coloured glass substituted in their place.

This mineral was named smaragdus by the ancients. Pliny distinguished twelve species of the smaragdus; but under this title he includes, besides the true emerald, also green jasper, malachite, fluor spar, serpentine, and some varieties of gypsum. Theophrastus also mentions the true emerald, which he says occurs in small quantity, and very rarely: he enumerates along with it another mineral of a green colour, which he informs us is found in masses ten feet long, and is probably a variety of serpentine. The emerald with which the hall of Ahasuerus was paved; the pillars of emerald in the temple of Hercules, at Tyre, mentioned by Herodotus; and the large emeralds described by Pliny as having been cut into columns and statues, cannot be referred to the true emerald. Indeed the confusion that prevails in the descriptions of this mineral in ancient authors, has led some mineralogists to believe that the true emerald was not known till after the conquest of Mexico and Peru by the Spaniards. The primitive form of the rhomboidal emerald is an equi-angular six-sided figure, and the prismatic emerald has a strong double refractive power.

EMEU. A very singular bird of New Holland, classed by Cuvier in his order *Echassiers*, or stilt birds, and in the division *Brevipennes*, or those which have no feathers fit for flight, but perform all their progressive motions on foot upon the ground. If *Brevipennes* is to be retained as the name of the division, and as it is founded upon the most remarkable external character of the animals, there can be no other objection to it, than that it would require to be divided into two families, *Struthionides*, or fast running birds, and another to include the apteryx, and the dodo, if they ever should be found in the live state.

There are four distinct races of the swift running birds, the ostrich of Africa, the rhea of South America, the cassowary of South Eastern Asia, and the emeu of New Holland, the bird more immediately under consideration. Each of these has characters sufficiently distinct for entitling it to rank as a separate genus, though no generic name that is quite unobjectionable has yet been given to the emeu.

The emeu is a very large bird, bearing some resemblance to the cassowary of Asia, and has been in consequence often called by the same generic name. It wants, however, the horny plate, or helmet, which characterises the other, and there are besides many differences between them. Perhaps the other bird of the family which it resembles the most is the African ostrich, but still there are many points of dissimilarity. Its body is more clumsy than that of the ostrich, its neck is rather shorter, its legs are also shorter, and, perhaps, stouter, and its feet have three toes, all directed

to the front, while those of the ostrich have only two. The claws, also, have something of the form of those of the *rasorial*, or scraping birds, while those of the ostrich have more the appearance of nails. The feathers on the emeu are all of a loose and flocculent texture, intermediate in appearance between the feathers of flying birds and loose and silky hair, matted into small locks, but none of them have that graceful form which is so much admired in the produced feathers of the ostrich. The feathers are of a dull sooty brown colour, with some markings of obscure grey, which appear as if the darker colour had been worn off. The head and neck are small in proportion to the size of the bird, and are nearly destitute of feathers. The wings are very short, of the same sooty colour as the back, and the only feathers which they contain are loose and hairy down over the sides. They act as balancers when the bird runs, but they are totally useless for flight. The bill is of mean length, straight, and ridged on the culmen, but does not advance in the form of a plate on the forehead. The young are streaked with brown and dull white, and they retain for a considerable time a portion of the down with which they are covered when they leave the shell, intermixed with the young plumage. The sides of the head are thick with this down after the birds have attained considerable size. They have sometimes been figured in this state as the mature birds, and thus led to the forming of very false notions of them. In their mature plumage, the two sexes differ little from each other in colour.

The food of the emeu consists of vegetable substances, such as grass, buds, berries, and roots; and from the structure of its toes and claws it is probable that it may occasionally scrape the ground in search of the last. It is, however, a very shy and timid animal in its native haunts, the wilds of Australia; and it is so very swift footed, that very little is known of it in a state of nature, farther than can be observed when it is hunted. Of course it nestles on the ground, although most probable in the extended copses, or "bush" as they are called in that country, as these are the places in which it seeks safety when hunted by dogs, and if it can reach them it is in general safe. The eggs are about five or six in a hatch, nearly the same size and shape of those of the ostrich, but of a sea-green colour. They are edible, and one reason why the number of the birds is but small as compared with the extent of their pasture, is the assiduity with which the eggs are sought after by the "bush-rangers," or runaway convicts, and the more lynx-eyed aboriginal inhabitants. It does not appear that these birds form any very regular nest, or, indeed, a nest of any kind, and the formation of nests is not a general practice with ground birds, few of the gallinaceous birds giving themselves that trouble. What may be the physiological cause is not known, but the physical fact is certain, that birds are careful in the formation of their nests in proportion as they are air birds, and depend upon the wing for the finding of their subsistence. It should seem from this that, as we have had occasion to remark in some previous articles of this work, the production of feathers fit for rapid or continuous flight, is the operation which in the feathered tribes requires the greatest care. We find evidences of this curious fact throughout the whole class of birds, as they all have a nest carefully prepared, and remain longer in it, in proportion as they are more decidedly birds of flight; and even

among the ground birds which do not, as we have said, form elaborate nests in any instance, we have a gradation in the rude and rudimental place for the hatching. The ostrich may be regarded as the most completely wingless of birds with whose manners we are acquainted, and the ostrich deposits her eggs upon the bare sand, though she does not abandon them then, especially when the cold nights and the dew (for there is dew even on Sahara) set in, as is stated in the vulgar accounts of the bird. The emeu is not an inhabitant of quite such barren places as the ostrich, and she therefore, we believe, generally, if not invariably, drops her eggs in the bush, and both male and female sit upon them. There have been some peculiarities noticed of the emeu in a state of domestication, of which we shall have to take some notice afterwards, but no inference can be drawn from them as to the conduct of the birds in a state of free nature.

In their native haunts among the plains and brushes of Australia, the emeus have, since the colonisation of the country by Europeans, had two sets of enemies to contend with, besides the native dogs, which of course have been enemies to them under all circumstances.

In the open plains, it is not very easy for the colonists to come so near the emeus as to make them gun sport, and lying in wait in the bush is not a very noble sport. Thus they, in general, prefer (we believe) coursing the birds with swift dogs. The dog must be very swift in order to come up with the emeu, and the coming up with the herd is rather more ticklish than that with animals which are are coursed in European sport. The emeu kicks with vast force; and the size and vigour of the foot are such that, if the stroke were to take effect, it would fracture the skull of the strongest dog, and lay him dead on the ground in an instant; the dog thus requires to be trained in a peculiar manner. He must not make his approach directly in the rear of the bird, as in that case, the stroke of the foot would take effect, and the triumph of the bird would be final. He must come to the side and seize the body of the prey, in which case he is safe, and the emeu is subdued at once. But even when the dog is so trained, the bird has the better of him in the first part of the chase, and it is only when the run is so long that it loses wind, that it can be taken by the dog, be his racing what it may.

This is a curious fact in the different economy of birds and mammalia. As a denizen of the air, a bird is lungs all over, and does not appear to lose wind under any circumstances; the fact of its falling a prey to another bird in the air, appearing rather to be the failure, or the inferiority of muscular exertion. But on the ground, which is the proper arena of the mammalia as a class, and not that of the birds, it seems from this case of the emeu, that the bird fails from laboriousness of breathing. This is a very curious subject, but we have no room, neither is the present the place for entering into any explanation of it,—in all probability it would not be very easily explained, until some farther observation and investigation have been made. Indeed the peculiar circumstances which adapt classes of animals to their elements, have been too little attended to by writers on natural history.

As the European settler, with his hound, is the enemy of the emeu upon the open plain, so the native Australian, with his spear, is its enemy in the bush. There he lies in wait; and as, by being practised from

the earliest time that the hand has any power of action, the aim of the spear is very certain, the bird seldom escapes from it if it comes within spear range of the lurking savage.

Between these enemies the numbers of the birds are very much reduced, and it does not appear that any attempts are made to increase their numbers by domestication in the colony, though they are very easily domesticated. As food, they are not indeed so palatable as many birds of smaller growth. As they are running birds, with no power of wing, the whole of the growth is concentrated upon the posterior part of the body; and, with the exception of the thighs, there is no part of them that contains any muscle worth eating. When the bird is in good condition, a great quantity of soft fat accumulates upon the rump, and all the hinder part of the body. This fat is of the same rank description as the fat of a goose, or even more so, and does not increase the value of the bird as an article of food, at least to persons of any delicacy of taste. As is the case with the accumulated fat of almost all birds, it consists wholly or chiefly of *elaine*, or oily fat, without any admixture of *stearine*, or crystallisable matter, so that if it were cooked with the flesh of the bird, it would be so rancid as not only to be not edible itself, but to spoil the rest. It is, therefore, removed before the part of the bird which is made use of as food is cooked; and the quantity is so considerable, that the emeu is often hunted for the sake of its oil, by those who care nothing for the flesh. When the flesh is an object, it is only that on the thighs which is so, for on the rest of the body it is so small in quantity, as not to be worth taking off the bones. Even on the thighs it has none of the delicacy of the flesh of ordinary birds, but rather resembles beef; and in the old birds it is exceedingly tough, though in the young ones it is more tender, and far from being unpalatable. The flavour of the legs, or rather the thighs of these birds, being that of beef rather than of fowl, is not an uninteresting point in physiology, the more so that there is an approximation to the same thing in other birds. The less that any bird, in the general character of its class in wild nature, is dependent on the wing, and the more that it is dependent on the foot in its economy, the more does its flesh resemble that of the mammalia. Thus in a common fowl, the legs are darker in the colour, and have more the flavour of beef than the wings, or than the muscles on the breast, by which the wings are put in motion. It should seem that the aerial muscle is in all cases less loaded with blood than the ground one; for the darker hue and the peculiar flavour may be, in great part, attributed to the quantity of that fluid contained in the capillary vessels; and if the ground part of the bird is not hardened by too violent exercise, it is probable that those dark portions that have a relation to walking, would be much more racy and nutritious than the paler ones which are connected with the organs of flight. In capons, which have little exercise, the legs are the best parts, and even in common fowls, though they are perhaps not the most in esteem, they are certainly the most juicy and the most wholesome. Nor is there any doubt that in the using of birds as food, every bird is more wholesome in proportion as it is more a ground bird.

These facts are worthy of some attention, with reference to the emeu. It is a very hardy bird, bearing the climate of Britain very well, and if attended to, would, in all probability, be much more

easily reared than some others of the birds which are bred for domestic use—than the turkey for instance. Besides, emeus are by no means chary in their feeding. The pastures of New Holland, though extensive, are any thing but rich, the grasses are scarce, the berries are harsh, and few of the roots contain much farinaceous matter; so that, in a state of nature, the emeu may be said to live upon the very coarsest food—food far inferior to that of any sort of poultry in this country—so that it might, in all probability, be introduced with advantage as an economical bird.

Though timid and shy in a state of nature, it is tamed with the greatest ease; and when tamed, it is exceedingly gentle. Those which the Duke of Devonshire had at Chiswick, notwithstanding their great size, never showed any symptom of pugnacity, but were mild, and even playful. In the cold weather they amused themselves by dancing; and in no case did they attempt to make an attack upon any other creature.

It should seem, therefore, that the emeu is a bird which could be introduced into the farm-yards in this country with great ease, and with no inconsiderable advantage. Nor is there any doubt that if it were subjected to no more exercise than were necessary for the preservation of its health, the flesh would become much more tender, and the bird really be valuable in an economical point of view. But, in these matters, as in all others, the mere economy of pounds, shillings, and pence is not the only economy, any more than mere eating and drinking are the only enjoyments of human life. It is desirable that the farmyard should be a study of information, and a source of intellectual pleasure, as well as a means of profit; and for this reason the more animals that can be introduced into it, the better must it be for all parties.



Emeu.

Hitherto emeus have been introduced into this country only as objects of curiosity, without any reference to economical purposes, or even to the means by which their numbers might be most certainly and successfully multiplied. That they will breed in the open air in our climate, is proved by the fact of their actually so breeding at the farm which the Zoological Society of London had between Rich-

mond-park and Kingston. Their conduct there shows that the male takes more interest in the rearing of the young than is done by any of our common domestic poultry; and from the attention which he shows in this respect, there is reason to believe they are monogamous. While a pair of these birds were kept in a pen at the place mentioned, the female, in the early part of the summer, dropped at different times nine eggs. She made no previous nest, nor did she appear to take any care about dropping the eggs in the same place. But they were no sooner dropped than the male bird took charge of them. As they were dropped he rolled them gently along with his bill, collecting them together; and set about performing the labour of incubation. This he continued to do with the greatest assiduity for the period of nine weeks. The result of this paternal incubation was the production of five young emens. These birds are now so well-known in this country, that farther description is not necessary.

EMMET. A little insect, sometimes also called a pismire. These two names were employed by our earlier authors for the ant.

EMPETREÆ—the Crowberry family. A natural order of monochlamydeous dicotyledonous plants containing three or four genera, and a similar number of known species. This order appears to hold an intermediate place between *Euphorbiaceæ* and *Celastrineæ*, to the former of which it bears a strong affinity. It is at once distinguished by its inferior distinct imbricated sepals, its definite ascending ovules, its distinct stamens, and its want of petals.

Its essential botanical characters are: flowers diœcious; sepals consisting of many hypogynous imbricated scales; stamens equal in number to the sepals, and alternate with them; filaments long; anthers roundish, two-celled, the cells distinct, bursting longitudinally; ovary free, situated on a small fleshy disk, three, six, or nine celled; ovules solitary, ascending; one style; stigma radiating, the number of its rays corresponding with the cells of the ovary; fruit fleshy, surrounded by the persisting calyx, three to nine-celled, the coating of the cells bony; seeds solitary, ascending; embryo cylindrical, in the axis of a fleshy somewhat horny albumen; radicle inferior.

The plants belonging to this order are small heath-like shrubs, with evergreen, alternate or whorled, exstipulate leaves, and minute axillary flowers. They are found in Europe, North America, and the Straits of Magellan. Many of them possess acid properties. The chief genera are, *Empetrum*, *Corema*, and *Ceratiola*.

Empetrum nigrum, black crowberry, or crakeberry is abundant on mountainous heaths in the north of Britain. It is a small branching shrub bearing black clustered berries, which afford abundant food to the moor game. The plant endures cold well. Its berries are eaten by the Highlanders, but they are by no means a desirable fruit, and if taken in large quantities are said to occasion headach. Although watery and insipid, they sometimes prove very acceptable to the traveller on the mountains. They are used as food by the Russian peasants, and in Kamtschatka are boiled with fish. They are said to possess anti-scorbutic and diuretic properties. When boiled in alum they yield a dark purple dye. The crowberry is the badge of the clan Maclean, in Scotland.

EMPIDÆ. A family of dipterous insects, belonging to the section *Tanystoma* of Latreille, nearly al-

lied to the *Asilidæ* (see BOMBYLIIDÆ), from which they differ in their smaller size, less robust structure, and in having the proboscis long and perpendicular. The head is nearly globular, and the eyes very large. These flies are of small size; they are very numerous in respect to their species as well as to the number of individuals. Some of the species may be noticed in the summer flying in great numbers, and with great velocity, over standing waters close to the surface, over which they rush as though impelled by the wind; others are found in trees and upon plants, where they prey with avidity upon other insects, and so greedy are they that we have noticed them thus occupied even during coupling. There are numerous generic and sub-generic divisions, resting merely on minute structural differences.

In the typical genus, *Empis*, the proboscis is much longer than the head, the terminal style of the antennæ biarticulate and short. The type of the genus is the *Empis borealis* of Linnæus, a species found in Ireland, having the wings broad and black, and the hind legs in the females plumed.

EMPLEURUM (Hortus Kewensis). A small, ornamental evergreen shrub, native of the Cape of Good Hope. The flowers are monœcious, and rank in the order *Diosmeæ*. It is a greenhouse plant of easy culture.

ENCELIA (Cavanille). A genus of two evergreen shrubs, natives of South America, belonging to the natural order *Compositæ*. The flowers are orange or yellow, grow well in any light soil, and require ordinary greenhouse treatment.

ENCEPHALUS (Kirby). A genus of minute coleopterous insects, belonging to the section *Pentamera*, family *Staphylinidæ*, and subfamily *Alcocharides*, having the head small and inflexed, the thorax very short and broad, the abdomen short and very broad, flat above, with the margins elevated and notched, the antennæ thickened at the tips, and the palpi with the last joint slender. The peculiar form of the various portions of the body above described enables the little creature, constituting the type of this genus, to accomplish a mode of defence against its enemies, which, from its singularity, will not fail to interest the observer of nature. Amongst the various means by which insects are enabled to defend themselves when attacked, the instantaneous imitation of death is one of the most efficacious; this is effected by different insects in different manners. In some cases, as in the *Ptinidæ*, the limbs are simply laid along the breast and held there in a state of rigidity until the danger is over; in others, as in the mimic beetles (*Histeridæ*) and pill beetles (*Byrrhidæ*), these limbs are suddenly folded up and received into cavities prepared on the under side of the body for this express purpose; others again roll themselves into a ball, by bending the head and posterior extremity of the body beneath the breast, whereby the legs are covered, and the insect appears like a morsel of stone or a seed. This is the mode adopted by the genera *Agathidium*, *Leiodes*, and *Clambus*, in the coleopterous order, and by the beautiful *Chrysididæ* in the hymenopterous order. This manœuvre however, as we have shown in our article upon the latter family, does not always succeed, the insect mimic escaping, it is true, with its life, but suffering the loss of its wings. But a more common and repeatedly observed instance of the adoption of this kind of defence is found in the common wood louse (*Armadillo vulgaris*), which, when disturbed,

rolls itself into a globular mass, so completely destitute of all appearance of life, or even of animalism, that it looks rather like a striped bead, and indeed by ignorant persons it may be, and in fact has been, mistaken for one of these ornaments. Swammerdam relates an instance in which one of his maid servants, having found a number of these insects rolled up, began to string them with a needle and thread, but, as may be easily conceived, the insects very soon gave unequivocal signs of life, "being obliged," as Swammerdam says, "to throw off the mask and resume their motions; on seeing which the maid servant was so greatly astonished that she threw away the woodlice and the thread, and cried out and ran away." The encephalus has a different mode of effecting the same object. Instead of bending the abdomen beneath the breast, as in the instances above mentioned, we find it turned upwards and thrown over the back, its flat upper surface laying close upon the clytra, the toothed edges of the former forming a kind of overhanging edge to a convex roof composed of the under-side of the abdomen; the head, moreover, is applied close to the breast, so that the insect now resembles a small round pebble of a shining black colour. In the ordinary species of the *Brachelytra* (see the figure of the Devil's coachhorse in the article upon that group) the abdomen is occasionally turned upwards, but in the insect in question this power is carried to its greatest extent, and applied, as we have seen, to a purpose different from that for which the attitude figured is employed, namely, the discharging of a caustic or pungent smelling fluid or vapour from the extremity of the uplifted abdomen.

The type of the genus, *E. complicans*, is about one-sixth of an inch long, and is found in the winter in moss and in damp situations.

ENCHANTER'S NIGHTSHADE is the *Circæa lutetiana* of Linnæus, a common weed, growing in damp shady places. It has been observed by a late writer that, although this plant has been named after the famous mythological enchantress Circe, it is entirely innocuous, possessing neither deleterious or useful properties of any kind.

ENCYRTUS (Dalmann). A genus of minute hymenopterous insects, belonging to the section *Pupivora* and family *Chalcididæ*, distinguished by having the deflexed nerve of the upper wing attached to the costal nerve at the extremity of the latter, and by having the intermediate tibiæ and tarsi dilated. These insects are of very small size, but interesting on account of their peculiar construction, and of their economy, being parasitic upon various species of scale insects (*Coccidæ*), which they destroy in considerable numbers, whence they may be regarded as very serviceable aids to the gardener and horticulturist. The antennæ are subject to various remarkable modifications of form in the different species, of which there are a very great number, and the colours of the sexes are likewise very varied. In their motions they are extremely active; indeed, from the quickness with which they leap to a great distance, they are difficult to be captured. One of the species, *E. vitis*, attacks the vine fretter (*Coccus vitis*). The male is black and the female red. It is figured in Mr. Curtis's British Entomology.

ENDIVE is the *Chicorium endivia* of Linnæus, a well known salad and culinary vegetable, belonging to the order *Compositæ*, and giving a title to one of the sub-orders of that extensive natural order.

There are five species of this genus, one, the *C. intybus*, is British, and commonly met with by road sides and banks of hedges. In Germany it is cultivated for its roots, which, when cleaned and dried, are ground to powder, and used as a substitute for coffee. Three species are weeds, and the remaining one is our present subject.

This being a winter salad plant, it is needless to sow it before the first of June; if sown earlier it soon runs to seed. The second and third sowings should be made in the first and third weeks of July, and two other sowings may be put in during August.

The seed may be either sowed on seed beds, to be transplanted, or in drills where it is intended to stand for good. Although endive may be successfully transplanted, it does better to remain where it is sown. In fact, there cannot be a better way than sowing a double number of drills on the same seed bed, every alternate one to remain, and the intermediate ones to be transplanted.

The transplanting season continues from the end of June to the first week in October, and at this last mentioned period the plants should be placed in frames, under glass, for protection against the severity of winter. Whenever or wherever planted, it should have full room to spread; and if in its favourite soil, a rich light loam, fourteen inches between plant and plant will not be found too much. When transplanted into drills at this or any greater distance, the plants should be dibbed into shallow furrows made by the hoe; not only because it gives the roots a deeper hold of the ground, but very much facilitates the application of water, and which, if the season be dry, will be required not only when first planted, but occasionally afterwards, to induce a rapid growth.

As endive is never used until blanched, it is, as soon as full or pretty well grown, tied or earthed up for this purpose. There are various methods practised for accomplishing this object; gathering up the leaves all round into a compact bundle, and binding them in that state with strings of matting, is one of the easiest methods; or, instead of ties, drawing earth round each plant while so held up, answers the same purpose. Some blanch their endive by laying plain tiles on each plant, or by a long board laid along the rows. But it must be observed that in all cases the leaves must be perfectly dry when tied up or covered to prevent rotting, which would certainly happen were they tied up wet. In ten days the plants thus treated will be sufficiently blanched for use; so that to keep up a supply, a certain quantity, according to the consumption, should be consecutively tied up or otherwise blanched. By thus depriving the central leaves of the plant of light and free air, the bitter quality is corrected, and the crisp delicacy improved; besides, extreme whiteness is a great recommendation at table. Being one of the principal winter salad plants, it deserves every attention in order to have full-sized perfect plants in that season. Those sown at the end of July and during August are most to be depended upon for winter use. The soil can hardly be too rich for endive, and when allowed ample space it arrives at a fine bulk for salads for kitchen use before the winter sets in. When frost threatens, however, the plants must be removed to a place of safety. This is usually done by tying up all the largest plants on a dry day, and raising the roots out of the ground with good balls of earth, and replanting close together among dry sand, in a pit or frame that can be covered

by glass and mats in severe weather. Or if laid in a sloping bank of dry sand, in a shed or dry cellar, the endive thus protected will keep good for a considerable time. That planted in frames in October and covered with glass, or such as has been planted on dry borders to be occasionally covered with straw, comes in for spring use, and lasts till succeeded by lettuce.

The different varieties of this plant cultivated in Britain are, the green curled, white curled, green broad-leaved, and white and new Batavian. The two first are preferred for their elegant appearance at table, and the last are mostly used for stewing, but are excellent and wholesome salad herbs.

ENDROMIS (Ochsenheimer). A genus of handsome moths (*Lepidoptera Nocturna*), belonging to the family *Bombycidae*, and to the section having the wings entire, and forming a triangle in repose. The body is short and thick, the wings somewhat pellucid, the palpi scarcely visible, and the antennæ in both sexes bipectinated. The type of the genus is the beautiful and rare moth known by collectors under the name of the Glory of Kent, *Bombyx versicolor*, Linnæus, which is of a rich brown colour, variegated with black streaks, and paler markings. The female is larger than the male, and of a paler colour. It is found very early in the year. We have seen the males flying with great velocity in the afternoon towards the end of March, in Coombe-wood, Surrey, in search of their sluggish females, which, from wanting the spiral spring and socket at the base of the upper wings, are unable to effect such a powerful flight. Mr. Haworth was of opinion that the males of this species "assembled," as the gathering together of many of this sex in search of an individual of the other, is termed by aurelians; but from the continued rarity of the species in our cabinets, this can scarcely be the fact.

ENGIDÆ (MacLeay). A family of coleopterous insects, belonging to the section *Pentamera* and subsection *Necrophaga*, or those species which feed upon dead animals and vegetable matters. The *Engidæ* seem to be more attached to the latter, since it is in putrid fungi, and in the neighbourhood of decaying trees, that they are more generally found. Many of the species are of a flattened form, with the body highly polished, enabling them to make their way with facility under the bark of trees; indeed, some of the species were arranged by Latreille amongst his *Xylophaga*, although the tarsi do not agree with the general structure of the true *Tetramera*, amongst which they were placed. It is true that many of them are not decidedly pentamerous, but their general appearance and their habits bespeak their affinity with the more typical species, such as *Engis*, *Ips*, &c., rather than with the *longicornes* or weevils. Indeed, these insects appear to be exceptions to the system founded upon the number of joints in the tarsi, rather than proofs of its incorrectness. The body is more elongate than in the *Silphidæ* and *Nitidulidæ*, and the antennæ are short and terminated by a club, composed of two or three joints.

It is difficult, in our present ignorance of the larvæ of many of the genera of which this family is provisionally composed, to assign exact limits to it, or to give other than very general characters. The lower jaws are generally elongate, and terminated by a strong brush of hairs; the palpi are short, and either filiform or but slightly clavate, and the legs are short

and slender. Mr. Stephens adds—"The family evidently requires sub-division, although in habit and economy, so far as known, there is great similarity, which, probably, only arises from the juxtaposition of the genera of which it is at present composed; the species usually subsist on decaying vegetable matter, either on fungi, agarics, the putrid sap of decaying trees, or upon flowers: they are found at the roots of grass, beneath bark, in fungi, and but rarely if ever, in putrid animal substances."—Illustr. Brit. Ent. iii. p. 57.

The species are generally of small size, indeed some of them are amongst the most minute of the insect tribes; the *Atomaria minutissima* being scarcely one-hundredth part of an inch in length. The principal genera are *Cryptophagus*, *Atomaria*, *Engis*, *Ips*, *Nemosoma*, *Cerylon*, and *Latridius*, to which *Sylvanus* and *Mycetophagus* may be provisionally added.

The typical genus *Engis* has the body oblong, oval and convex, the antennæ short, thick, with a three-jointed club; the legs are short and stout, and the tarsi five-jointed. There are several British species, the type being the *Dermestes scanicus*, Linnæus, a species about one-sixth of an inch long, found in boleti, &c. Some of the exotic species are of a much larger size, and must be of infinite service in clearing away the putrifying masses of vegetation which abound in tropical climates.

ENKIANTHUS (Loureiro). A genus of beautiful and highly ornamental Chinese plants, belonging to the tenth class of Linnæus, and to the natural order *Ericaceæ*. Generic character: calyx bracteate, five-cleft, persisting; corolla bell-shaped and slightly five-cleft, with five nectariferous cells in the bottom; stamens inserted into the base of the corolla; filaments pilose and dilated at the base; anthers two horned, having double pores which open at the apex; style filiform and persisting. Drawings and specimens of the *E. quinqueflora* were first brought to England, under the name of *Andromeda arborea*, in 1794, as no small plants were purchasable at Canton in the previous year, but living plants were received in this country in 1812. No plant is more regarded by the Chinese as a domestic ornament than this when in flower. Small branches of it are sold in the streets of Canton about the first of March, and nearly for the same purpose as holly and mistletoe are sold in London before Christmas, viz., for decorating places of worship, and for placing before the images of Joss in their houses. The branches are cut from the trees just before the flower-buds are expanded, and placed in vessels of water, where they bloom beautifully. The flower-buds being terminal, and each containing four, five, or six flowers of a delicate pink colour, hang gracefully from the point of every spray. As the leaves are not produced in water, and as the spray is arranged very neatly in the vessels, they are aggregately a beautiful object. Every street window is more or less decorated with these flowers in the season, and which shows that there must be vast numbers of the trees in the vicinity of the city, and yet not one small plant could be found in the nurseries in the spring of the year 1794, though twenty dollars were offered for a potted plant. Another species, the *E. reticulata*, was added to our collections in 1822; and as they are nearly deciduous trees, hopes may be entertained that they may be in time inured to our climate. They are propagated by cuttings.

ENTADA (Adanson). A genus of plants found both

in the East and West Indies, belonging to *Polygamia Monœcia*, and to the natural order *Leguminosæ*. Generic character: flowers polygamous; calyx bell-shaped, five-toothed; petals small and oblong; stamens ten or more, elongated; anthers roundish; pod very large, compressed, jointed; valves often separated in two by a membrane. These are climbing plants, and have been called mimosas by several botanists; and by Forster, one of them was called *Adenantha*. They are treated as stove plants and propagated by cuttings. The chief peculiarity of these plants is the immense size of the pods, those of one variety are six or eight feet long, and, being gently curved, resemble gigantic cimeters. Their seeds are nearly six inches in circumference.

ENTALIUM (De France). A fossil species of shell, of the genus *Dentalium*. It includes such species as have the tube narrowed near its orifice, with an interior tube throughout its length. The *Dentalium duplicatum* illustrates this genus.

ENTELEA (R. Brown). A deciduous tree, native of New Zealand, introduced in 1820. It belongs to the natural order *Tiliaceæ*; is treated as a greenhouse plant, where it flowers, and occasionally ripens seeds, by which it is propagated as well as by cuttings.

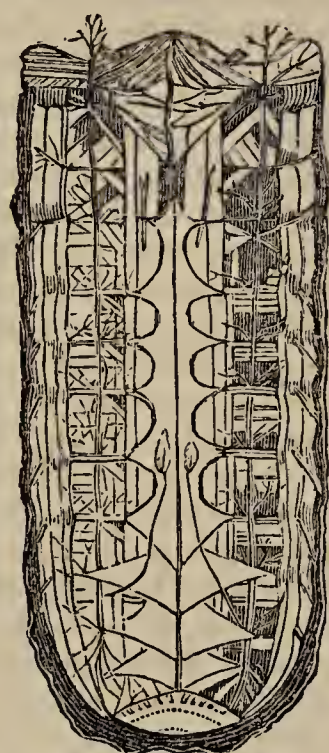
ENTOMOLOGY. That portion of zoological science, which treats of the insect tribes, as restricted by the knowledge obtained by the elaborate researches of modern comparative anatomists. The term is derived from two Greek words, *entomon*, an insect, and *logos*, a discourse; the former word, as well as the synonymous Latin word, *insectum*, which we have Anglicised into insect, being themselves compounded of other words, signifying a cutting or dividing into sections or articulations, whence, in fact, we arrive at one of the great characteristics of these tribes, namely, the articulated structure of the external parts of the body, which being of a corneous texture, serve as supports for the muscles and other internal organs, just as the internal vertebræ of the higher animals support the same parts; so that in these portions of the invertebrata, the external covering may properly be regarded as the skeleton. Now this character joined to those derived from the respiratory, nervous, and locomotive systems, tend to separate the true articulated animals from a great number of other small creatures, with which, under the common name of insects, they are classed, even in some of the latest popular compendiums of natural history which have issued from the press, in which the leech and snail, together with many of the still lower animals, are introduced, without even a sectional note of distinction, amongst insects.

If we look around, on every side, in every place, and in every season, we behold the immense profusion with which nature has scattered the objects of our present meditation over this world of ours. The earth, the water, and the air, teem with insect inhabitants; every vegetable supports numerous colonies; the diminutive fungus and the gigantic oak are alike subject to their attacks; and as a proof of the vast extent of the series, it may be added, that Saint Pierre tells us, that several hundred different species of insects visited a small rose-tree placed in the window of his study, whilst a single forest tree is the abode of numerous tribes and families. In like manner they cease not in their attacks upon animal matter, both in a dead and living state; and, as we have already had occasion to mention in these pages, man himself, the lord of all, is not exempt

from annoyances from them. How necessary, then, from the insurmountable difficulty resulting from the almost infinite numbers of these creatures, is it that we should bespeak the indulgence of our readers in our attempt to lay before them, in as concise a manner as possible, a sketch of the insect world. It is not difficult to imagine the painful nature of the researches necessary for obtaining a knowledge of the internal anatomy and other peculiarities of creatures, of which by far the greater portion do not exceed an inch in length. And here it is that we, in the most especial manner, discover the invaluable worth of the microscope, that surprising instrument, by which the minute wonders of the creation are brought as vividly before the eye of the observer, as are the wonders of the celestial sphere by that other philosophical wonder, the telescope. These instruments are now, it is true, no novelties; but we know no more striking instances in which the powers of the mind have worked a victory over nature.—Speak of the powers of the steam-engine, and the many hundred times by which the manual forces of the human frame are increased by its operations—and what is this in comparison with the tens of thousands of times to which the ordinary size of the meanest insect is increased by the assistance of the microscope? Still the continued employment of this instrument is a painful operation, increased a thousand fold by the minuteness of the objects, and the extent to which it is necessary to carry the investigation of them. Look at the unwearied labours of Lyonnet, which were for years devoted to the anatomical examination of a single insect; or of those of Straus-Durckheim, whose memoir upon the cockchafer exhibits almost an equal endurance of observation. If, moreover, we consider that not only does an insect combine within itself the systems of respiration, circulation, digestion, secretion, and sensation, analogous to those of the higher animals, but also that owing to the remarkable circumstance that the majority of these animals undergo a series of transformations, whereby these systems are completely altered several times in their progress to the perfect state, it is essential to extend our observations to every period of the life of the animal, before we can arrive at a perfect knowledge of its structure, so as to enable us to form a proper estimate of its comparative anatomy; we cannot, therefore, but admit that the difficulties attending the labours of the entomologist are not fewer than those in any other department of nature; difficulties, which, from their very nature, cannot cease to arouse the attention of the devoted lover of nature. And hence arises the necessity of our having recourse to the labours of our predecessors in the vast field opened to us, and in the works of Swammerdam and Lyonnet, De Geer and Reaumur, Latreille and Kirby, we find the materials, not for a short essay, as ours must be, at its greatest extent, but for volumes upon volumes.

Of all the classes of zoology, then, that of insects is the most numerous, the most beautiful, and the most varied; and though it cannot be denied that no portion of the science presents to those who are ignorant of its merits, so many apparent points of repugnance; yet which, nevertheless, so much captivates the attention the more its merits are examined. It is, indeed, for those who undertake its investigation, an unceasing source of instruction and of pleasure, open to all, requiring not, like the classes of quadrupeds or birds, great pecuniary sacrifices in the col-

lection of materials; but yet possessing for every observer a still unopened mine of knowledge, even in the very commonest species. Volumes have been written upon the bee; but still how many wonders of the hive remain unexplained? The domestic fly swarms in every apartment, and yet how many points in its economy are uninvestigated? And, which is not less peculiar and interesting to the student of the insect world, he may pursue his observations without pain to the objects of his research; he may watch them at their occupations, observe their manœuvres, and contemplate the beautiful harmony which exists between their organisation and their economy, and leave the contemplation "a wiser and a better man." Here he will find life in its widest extent; sensation and motion are here bestowed to a degree



Muscular system of the caterpillar of the goat moth (*Cossus ligniperda*).

even far exceeding that of the higher animals; and it is this which constitutes one of the greatest charms of the pursuits of the entomologist. The botanist may boast of the splendour of his flowers, the conchologist may glory in the beauty of his shells, and the ornithologist in the interesting economy of his birds; but the entomologist can do more, since the objects of his pursuit are not less splendid than flowers. Indeed, what flower can vie with the brilliant butterflies of South America?—Neither are they less beautiful than the most beautiful shells—for what shells can vie with the splendid coatings of the *Chrysididæ*, or with the extraordinary forms of the *Dynastes*?—Neither are they inferior to the feathered tribes in their varied economy, whilst the very circumstance of their infinite numbers and ubiquity renders their observation a matter of comparative facility. If we notice them with reference to the latter peculiarity (that of their varied economy), we find them occupied in works as varied as those of the most consummate mechanic and artist. Here we find one suspending itself by a series of mechanical motions, by one extremity of the body, whilst others keep themselves from falling during their state of inactivity, by passing a cord round the middle of the body; here some construct, for the like purpose, a bed of the finest silk, whilst others, with the greatest ingenuity, form their domicile of other and very differ-

ent materials, differing in the different species, whose economy is consequently different. Some unite to form a common lodging, whilst others separately incase themselves in a coat of wool as soon as they are born. In many instances the patient care of the female in the construction of her nest, and in the preservation of her offspring, is not surpassed by the highest amongst animals. In all these things, and in the infinite diversity of means exhibited by insects tending to one common end—the preservation of each—the supremacy and wisdom of a Divine Intelligence, creating all things—preserving all things—directing all things—are so pre-eminently conspicuous, that it is impossible, even whilst paying but the slightest degree of attention to such things, to overlook the sublimity of the science, nor not to be filled with the most profound respect for the all-powerful wisdom and goodness of the Creator, and, even in the midst of the most profound grief, it is impossible to contemplate these wonders of the creation without an assuagement of our pain.

If, moreover, we would institute a comparison between the objects of our present contemplation, and those of the higher ranks of nature, we shall find here assembled all those striking peculiarities which abound in the latter; the piercing eye of the lynx and the falcon, the hard shield of the armadillo, the splendid tail of the peacock, the imposing horns of the stag, the swiftness of the antelope, the fecundity of the hare, the architectural powers of the beaver, the climbing powers of the squirrel, the gambols of the monkey, the swimming of the frog, the burrowing of the mole, and the leaping of the kangaroo; all these things are found amongst insects, and often, indeed, in a redoubled degree. Then, the eye of the fly, with its thousands of lenses, the horns of the stag beetle and dynastes, the splendour of the scales upon the diamond beetle, the hard covering of the beetles (whence even their ordinal name, *Coleoptera*, wings in a case), the admirably constructed works of the hive, the maternal cares of the spider, which guards its bundle of eggs with incessant care, carrying them about with it beneath its body; the ingenuity of the cocoon of the emperor moth, constructed with an elastic aperture, preventing the entrance of enemies, but allowing exit to the inhabitant; the numberless progeny of the aphis, the powerful flight of the locust, the leap of elater and grasshopper, the brilliant light of the glow-worm, the instinct of the burying beetles (*Necrophagus*), the mottled jacket of the larva of the clothes-moth, formed of different coloured wool, or the excrementitious covering of the larva of the *Cassida*, the frothy abode of the *Cercopis*, the abandoned shell inhabited by the hermit crab, and the extraordinary gall residences of the *Cynipidæ*; all these, and a thousand other not less interesting circumstances exhibited, and to be exhibited more at detail in our pages, cannot fail to convince the reader that the class of insects does not possess fewer claims to his attention than any other of the classes of nature.

The continued action which insects exercise upon the other productions of nature (and we may mention, in passing, as a most conclusive evidence of such action, that the island of Grenada is now reduced to a ruinous state owing to the attacks of the diminutive cane-fly upon the canes, having extended nearly throughout the island), the insurmountable power of these enemies, owing to their minuteness, the injuries which they inflict upon our possessions, animal and vegetable, the benefits arising from many of them, their extraordinary forms and transforma-

tions, rivalling the most striking creations of fable, the complexity of their organisation, external and internal, their inconceivable industry in the construction of their nests, and the foresight which they manifest in their self-defence, all teach us that entomology is well worthy of the attention of the observer of nature.

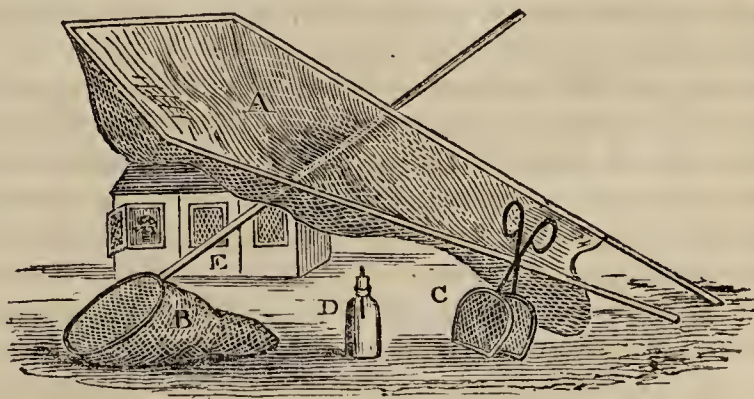
But it will be said, why devote our attention to objects so minute? We reply, if the colossal alone be worthy of notice, search elsewhere for the objects of your notice, for here the objects are so small, that the full stop at the termination of this sentence, is much larger than many of the species. But to the eye of philosophy, what matters colossal size and gigantic expanse? The wisdom of the Creator is concentrated in these minims of creation, in order the better to develop his power; since in these creatures, whose excessive minuteness renders it difficult, and even impossible, to observe some of them with the unassisted eye, how can we conceive it possible to arrange all the machinery which exists in the bodies of those little creatures, as perfect and as complex as in those of the largest? The little beetle (*Atomaria atomos*), and the minute parasitic fly (*Mymar monas*), although not one-hundredth part of an inch in length, possess precisely the same number of organs, and even of joints of those organs, as their larger brethren of the classes to which they respectively belong. To neglect this portion of the creation is to say, that these living machines, in which the rules of the most perfect mechanical knowledge have been implicitly followed, and of which the various parts are arranged with the utmost art, but which are nevertheless so fine and delicate as to escape our view, are less worthy of regard than the larger machines made precisely upon the same model. Absurd reasoning! Who does not regard skill of the artificer capable of forming a minute pocket watch with its delicate machinery, as more worthy of notice than that of the workman who can but construct a town clock?

Such being the claims which the objects of the entomologist's care possess upon his attention, we therefore proceed in the present article to state the most efficient modes of research, whereby also, the most satisfactory and pleasing return may be obtained for the toils of investigation, premising that we deem all animals destitute of internal vertebræ, having articulated bodies and articulated legs in the perfect state, to be insects; following, therefore, in the steps of Linnæus and Latreille, we consider *Crustacea*, *Arachnida*, *Acari*, and *Myriapoda*, as much entitled to the attention of the entomologist, as beetles, bees, or butterflies. Our reasons for this view of the subject, together with a general sketch of the anatomy and classification of the whole, will therefore more properly fall under the general article, *Insects*; the present article being confined to the preceding remarks upon the general claims of these minute animals to a share of the notice of the zoologist, to a sketch of the plan of study to be adopted, and to a view of the rise of entomology as a distinct branch of zoological science, from the earliest ages to the present time.

Entomologists, like the objects of their research, may be classified. First, there is the amateur, whose sole object is the procuring, either by capture or by purchase, of a collection of handsome insects, either to be placed in drawers, without any other arrange-

ment than that of beauty of colour or size, or in glazed picture-frames to be hung up in his room. This, it is true, is the lowest class of entomologists; but the labours of such amateurs are not without pleasure to themselves, and are sometimes serviceable to the science of entomology. The author of this article, who has been for days confined to the desk in the centre of this vast metropolis, can testify to the delightful sensations with which he has inhaled the breeze upon Shooter's-hill or Wimbledon-common, when on the way to those well-known entomological spots, Darenth and Coombe Woods; whilst the best practical collector whom we have ever heard of is Daniel Bydder, a Spital-fields labourer, by whom some of the most interesting of our English insects were first discovered. And in like manner Joseph Standish, a Brixton cobbler, from a pure love of entomology, taught himself to draw and paint insects; and having followed up this pursuit, during his leisure of many years, he has acquired the art of giving to his figures of moths, a beautiful downy appearance, so like nature, that we have known a volume of his drawings sold for many pounds. Can it be denied that if, amongst the lower classes, the collecting of objects of nature, and such-like pursuits, were more general, the vice of drunkenness and the reign of gin-palaces, would be over?

It is not, of course, our intention, in this work, to lay down an account of the instruments required, or the modes of collecting insects for the information of the mere collector. These will be found in Kirby and Spence's Introduction, in the "Insect Miscellanies;" or in Mr. Ingpen's little manual devoted to this subject. Suffice it to say, in this place, that when captured and killed, either by immersion in scalding water (as is usually done with beetles) or by being placed in a close small box with bruised laurel leaves (as is very serviceable with flies, moths, &c.), the insect is stuck through one of the wing-cases (if a beetle), or between the wings (if a fly or moth), with a pin proportioned to its size; the entire collection being preserved in chip-boxes, or in a cabinet of shallow glazed drawers, having the bottom lined with cork and covered with paper.



Instruments for collecting Insects.

A, The large gauze flap net. B, the sweeping or water net. C, the gauze forceps. D, the collecting bottle for holding small beetles, &c. E, the breeding cage.

Various kinds of nets are employed in collecting insects, such as the flap-net, for catching insects on the wing, made of fine gauze, resembling a bat-fowling net, and the sweeping net, for catching insects on grass and low herbage, made of strong canvas, and resembling a landing net. When secured, the insects are either immediately pinned, or carried home loose in quills or glass bottles. After they are killed and pinned, their limbs are arranged in a natural position by means of pins and bits of card, by which

they are retained in their places until they are dry enough to be placed in the cabinet. Caterpillars are kept in boxes with gauze sides, and fed with leaves of the peculiar plants upon which they are found, until they assume the chrysalis state; and in this manner moths and butterflies are procured with their plumage much more beautiful than when captured at large. Insects which may have become stiff before they have been displayed, are readily relaxed by placing them upon damp sand for a few hours. It is necessary that the store boxes, or cabinets, containing insects should be kept in a dry situation, otherwise the specimens soon become mouldy. It is not advisable to place them against an outside wall of an apartment; moreover, it is necessary that camphor should be kept in little cells in the drawers to prevent the attacks of mites or other insects, such as the *Anthreni*. (See *DERMESTIDÆ*.)

These hints will suffice for the practical collector and the professed amateur; for the more systematic entomologist, who is not content with merely collecting insects, but who is intent in classing his collections, arranging each in its proper place and under its proper name, and describing such as are nondescript, another plan of study is requisite. Of the nature of the pursuits of this class of entomologists, Messrs. Kirby and Spence, having previously spoken of them as possessing an agreeable and unfailing provision of that "grand panacea for the tedium vitæ" employment, make the following observations, "with what view is the study of the mathematics so generally recommended? Not certainly for any practical purpose,—not to make the bulk of those who attend to them astronomers or engineers, but simply to exercise and strengthen their intellect,—to give the mind a habit of attention and investigation. Now for all these purposes, if I do not go so far as to assert that the mere ascertaining of the names of insects is equal to the study of mathematics, I have no hesitation in affirming that it is nearly as effectual, and, with respect to giving a habit of minute attention, superior." Examples are then given of the necessity for minute discrimination in the examination of insects for the purpose of discovering the proper name of each and the descriptions to be given of it, if it should happen to be undescribed: but there is still another advantage to be gained from this kind of investigation. We will assert that no one who has studied the classification of insects, commencing with the class and going regularly through the orders, sections, families, genera, down to individual species, and neatly arranged his insects in his cases, can leave the subject without having gained certain principles of regularity and order, which will communicate themselves to his every-day employment, inducing a methodical correctness and precision in the details of life, which are so superior to the careless proceedings of the thoughtless and irregular.

By the student, therefore, who would attempt the classification of his collection, it is requisite that a progressive series of inquiries should be made. It is not fit that he should commence by the investigation of isolated species, his collection must be in the first instance generalised, since it is only by studying groups of insects in the mass that we can ever acquire any general views of the science. If this be not done we shall be constantly falling into the error of separating intimately allied groups, because their external appearance is different, and of uniting insects which,

from the difference of their organisation, are widely apart, because their appearance is similar. Let us take any every-day example of the want of this generalised view of insects; there is an extensive group of two-winged flies which are called drones, they are the very personifications of luxurious idleness, they do nothing but sip the nectar from the brightest flowers, and enjoy the sunshine basking upon the leaves of plants; and there is an extensive group of bees, having the same general appearance, but being in habits the very reverse of the drones; toiling all day long, either in the construction of the nest or in provisioning it with pollen paste. Now by ignorant persons the same name is given to both groups of insects, and not the slightest idea is entertained of the totally opposite nature of their habits.



A, Drone-fly (*Eristalis*). B, Spring Wild-bee (*Anthophora retusa*).

We are the more anxious to impress upon our readers the necessity for obtaining a generalised view of insects, and indeed of the entire productions of nature, because we know that many of our fellow labourers fritter away their talents and time in the sole elucidation of the characters of obscure species of insects, without a thought of the higher views which lay open before them. "English naturalists," says Mr. Bicheno, "appear to me, from various causes, to have pursued the nomenclature and examination of species in such a way as very much to exclude from their attention the higher ends of science, in which alone the bulk of mankind is interested. Ever since the subject has been pursued in the spirit of true philosophy, it has almost solely been confined to the analytic form which, however important, is apt to degenerate into unprofitable detail, as the synthetic mode leads oftentimes to the other extreme of loose and impracticable generalisation. "The necessity of knowing particulars has made our researches into species very minute, and has given to our operations in the eyes of the multitude rather a puerile cast. The method by which the name of an unknown species and all that has been written about it can be discovered necessarily involves such minute discrimination, that it cannot escape this superficial objection. It is however an inconvenience not incident to our subject alone, but to all the sciences more or less which require a minute examination of particulars." And he concludes by observing, "I am anxious not to be misunderstood; I do not want to disengage naturalists from attention to the analysis of species, or to absolve them from the labour of minute investigation which, after all, is our chief business; but I do wish to see them following nature through all her varieties with a view to generalise as well as particularise; to relieve the memory from the overwhelming multitude of names which the discovery of new species has imposed; and to compress the result into a size adapted to the human capacity. This may safely be pronounced to be among the highest efforts of a created intelligence."

Hence will be seen the necessity for studying collections of animals, and particularly of insects, in the mass; for though the knowledge of species, as Mr. Kirby has well observed, is indispensable for the registry of facts and other practical purposes, yet the knowledge of groups leads to a higher wisdom; and indeed it is through these that we best descend to the study of species. The first thing, therefore, requisite is, to ascertain to what order of insects any individual specimen may belong. For this purpose an inspection of the mouth (for the purpose of ascertaining whether it is furnished with jaws or with a sucker), and of the structure of the wings, will generally suffice. The next step is the separation of your collection into the primary sections and families of which the orders are composed; and here, of course, the characters will vary in the different orders, for instance, in the order of beetles (*Coleoptera*), the primary sections are founded upon the variation in the number of joints in the tarsi (or last articulated part of the leg); whereas in the two-winged flies (*Diptera*) this character is constant, and the number of joints in the antennæ constitute the leading characters of the primary divisions. For the families no better rule could be laid down than to study the characters of the Linnæan genera, which in fact correspond generally with the modern families of insects; but as we have already stated in several of our entomological articles, the contents of these groups have so immensely increased since the days of Linnæus, that it has become necessary to subdivide them into minor divisions, to which the names of genera and subgenera have been given; and here it will be necessary to have recourse to such authors as Fabricius and Latreille, Stephens, or Curtis, for obtaining an idea of the extent to which these subdivisions have been carried, as well as for obtaining a knowledge of the various subdivisions themselves. The practised eye, indeed, can readily reduce an extensive family of insects into its sectional groups without any other assistance than that derived from long experience, because the most nearly allied species possess such a general resemblance to each other, that it is almost impossible to overlook their relationship; for instance, the restricted genus *Carabus* comprises a very extensive series of ground-beetles, varying but little in size (compared with the variations in size which occur in the family), being moderately large, and ornamented more or less with metallic tints; so also among butterflies, the genus *Colias* comprises species being generally of a brimstone colour. We now arrive at the investigation of the specific name of the insect under examination, and here lies a great difficulty, owing in general to the number of species; great relief, however, is afforded by the introduction of subdivisions in the longer genera, by which we arrive almost immediately at the name of the species itself. In general the descriptions of insects are written in Latin, or at least, if an author chooses to give a specific description in his native tongue, it seems by common consent and usage to be required that he should commence his descriptions by a short Latin character, which, from the almost universal employment of that language in works of natural history, is intelligible to naturalists throughout the world. Moreover, the indication of the natural length and expansion of an insect, the addition of the country which it inhabits, and the references to the works of other authors by whom the species may have been described,

and especially where it has been figured, all tend to render this branch of the science less intricate than it at first appears. If, however, after all research into the works of those authors who have especially devoted their attention to the family or genus of insects, to which the one under examination belongs, it should be evident that it is a nondescript, its description, embodying the points of distinction which it presents with reference to the already described species, and whether resulting from structural variation, or from differences of colour, or of striation or puncturation (as in the beetles), may be attempted, taking as models the specific descriptions contained in such admirable monographs as those of Mr. Kirby upon the English bees, or the genus *Apion*, or that of Latreille upon the ants.

But the investigation of species, although valuable for the sake of precision in the identity of the object which is the subject of observation, is by no means essential for enabling us to study the structure or economy of an insect, and this brings to our notice several other classes of entomologists, who more especially merit the title of philosophical observers of nature. Of these the out-door naturalist first claims our attention. Instead of running from one end of the country to the other, climbing mountains and descending valleys, stopping only so long as may be necessary to transfix the luckless objects of his chase, and deeming himself happy only when his collecting box is filled with specimens, the real observer of nature finds materials for study even at his own door. The former, it is true, meets with many rarities, and even perhaps nondescript species, but notwithstanding all his toil, has he observed a single fact relative to the history and economy of a single insect? Swammerdam and Reaumur toiled not thus; and yet their labours are read even now by all the world, whereas the labours of the collector are but at best selfish, and the descriptions of his new species read only by a few amateur collectors like himself.

Seek then a spot favourable for the habitations of insects—a sunny nook in a wood, a hot sandbank, or the margin of a stream, and watch the proceedings of the numberless insects which frequent these spots.

Examine, for instance, the clear water, and watch the movements of the various aquatic insects with which it abounds; and especially observe the silvery silky globe which the diving water-spider bears about with it, and in which, in an enlarged form, it passes the winter. Observe the mode in which the insect,



Diving water spider, in its diving bell, fixed to plants at the bottom of the water.

resting upon a flower, extracts the honey from its cup; trace the flight of that sandwasp, and notice the peculiarities of its manœuvres in the construction of its burrow; examine with careful eye the movements of that sawfly in the act of forming a channel in the sprig in which to deposit its eggs; or listen to the

chirping of the field cricket, and trace it to the burrow, at the mouth of which it sits ready to dart upon its prey.

Notice these things, and then say whether these and a thousand other observations of a similar nature are not infinitely more interesting than the mere pursuit and capture of specimens, or the dry technical detail necessary for their specific determination.

"Those who have studied nature only in books," observes St. Pierre, "can see only their books in nature, they look upon the natural world only to find therein the names and the characters of their systems. If they are botanists they are satisfied to have discovered a plant of which some author has spoken, and having assigned it to the class and the order which he has pointed out, they gather it, and spreading it between two bits of grey paper, they sit down content with their knowledge and their researches. They do not form a herbal to study nature, but they study nature to form a herbal. It is in the same way that they make collections of animals, that they may learn their genera and species and treasure up their names. But can he be a lover of nature who thus studies her wonderful works? How great a difference is there between a dead vegetable, dry, faded, discoloured, whose stems and leaves and flowers are crumbling to powder, and a living vegetable, full of sap, which buds, flowers, gives forth perfume, fructifies, and sows itself again—maintains an universal harmony with the elements, with insects, with birds, with quadrupeds, and, combining with a thousand other vegetables, crowns our hills and adorns our banks. The animal loses by death even more of its characteristics than the vegetable, for the animal has received a more vigorous portion of life. Its principal qualities vanish, its eyes are shut, its pupils are dim, its limbs are stiff, it is without warmth, without motion, without feeling, without voice, without instinct. What a difference between the animal who enjoys the light, distinguishes objects, moves towards them, calls the female, couples, makes its nest or lair, brings up its young, defends them from their enemies, congregates with its kind, and gives music to our woods, and animation to our meadows."

But the out-door observation of these and such like subjects by the real lover of nature—and no one merits this name who does not bestow attention of this kind upon the objects of his research, leads to far higher considerations and views. Peculiarities of economy, and herein almost every species of animal differs from its neighbour, necessarily imply corresponding peculiarities of organisation, often indeed minute, and to be sought after with great care and labour, often with the assistance of the microscope. The philosophically minded student will therefore combine with the observation of habits investigation of structure, and in this latter particular lies the merit of such laborious naturalists as Lyonnet, Swammerdam, or Straus-Durckheim, who lay open to our view the minute intricacies of the internal anatomy of various species of insects. The following observations upon the connexion between these two branches of our subject, from the Introduction to the Menageries, will be read with pleasure, from the soundness of the views which they inculcate. "It is amazing how much quickness the habit of observation will impart to the whole intellect, and give it an aptitude for understanding and enjoying the thing observed. There is nothing, for instance, so common as to find

men wanting in a perception of picturesque beauty, of that feeling which enables some to take great delight in a landscape, not only for its extent, or the grandeur of its parts, but for the harmonious arrangement which is necessary to the effect of a picture, or for some accidental circumstances of light and shadow, or of colour, which render the prospect more than usually attractive. Now this is strictly an acquired faculty, and one which is produced by the practice of looking at nature or at the monuments of art, with the previous adaptation of the vision to picturesque objects; and a person who enjoys the faculty (we say enjoy, for it is a source of real pleasure) is said to possess a painter's eye. It is precisely in the same way that a naturalist, by constantly observing the peculiarities of animal life, acquires the readiest perception of the differences in the structure and habits of the great variety of living beings, and he perceives in each of them qualities which a less practised observer would entirely overlook. Through these habits of observation, the science of zoology, which comprehends all that relates to the description of classification of animals, has been gradually established. By diligent observations the *peculiar structure* of vast numbers of *individual* animals has been ascertained, their habits have been accurately described, and many ancient errors, which arose from hasty examination, have been exploded. Thus, in the more recent scientific works on zoology, the accidental circumstances of size or colour, or locality, or any identity in unimportant habits, have ceased to be guides in the classification of animals, but the *essential peculiarities of their formation, which chiefly determine their habits*, have alone been regarded. We mention this, to point out that the actual observations of successive naturalists, leading to the accumulation of a great body of facts, have principally contributed to the advance of zoology as a science in modern times, for the science being wholly founded upon observation, and not upon previous calculations, or any series of experiments, the greater our collection of facts the nearer have we approached to systematic perfection."

These views so fully coincide with our own opinions of the necessity for continual observation of facts, that we have not hesitated to introduce them into this article, although they are equally valuable with reference to every department of zoology. The observation of facts has been too much neglected amongst us; there is, however, one passage contained in the above extract, which appears to us to call for further notice. We are there told that "*the essential peculiarities of formation chiefly determine the habits*" of animals, and a little further we meet with the remark, that the systems of Cuvier, Blumenbach, and others, are founded upon a consideration both of the teeth and of the organs of touch, and therefore, "being formed with especial reference to *the two great distinctions which determine the most important habits of the animal*, are called natural systems."

Now this passage, and numerous others which we might quote from the works of other modern writers, both popular and scientific, to the like effect, appear to the author of this article to result either from very incorrect ideas of the system of nature, or from a carelessness of expression which leads us to imply the existence of such incorrect ideas. Let us not be misunderstood. These passages seem to us to imply that, in the opinion of the writers, a certain form-

ation being bestowed upon an animal, certain peculiarities of habit dependent thereupon are acquired. Observe the result:—if we adopt this mode of looking at the operations of nature, do we not immediately fall into one of the worst errors of some of the worst of the French philosophers? Do we not at once virtually deny the existence of design in the creation? It was upon this very point that our great philosopher John Ray contended with such eloquence in his "Wisdom of God in the Works of the Creation." Against the doctrine that the bodies of men and all other animals were the effects of the wisdom and power of an intelligent and almighty Agent, and the several parts and members of them *designed to the uses* to which now they serve, the atheist, he observes, has one subterfuge, in which he most confides, viz. that all these uses of parts are no more than what is necessary to the very existence of the things to whom they belong, and that *things made uses, and not uses things*, and in this spirit Lucretius says,

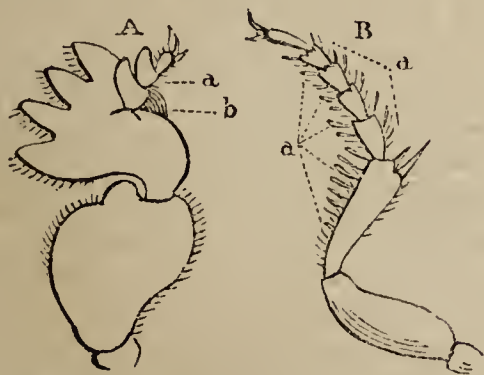
—Nil ideo natum est in corpore ut uti
Possumus, sed quod natum est, id procreat usum :

And again—

— Omnia denique membra
Ante fuere, ut opinor, eorum quam fuit usus.

So that, in the opinion of the atheist, all this admired and applauded usefulness of their several fabrics is but a necessary condition and consequence of their existence and propagation.

If it could be proved that the doctrine contained in such passages as those we have quoted, ought not to be identified with the atheistical doctrines above alluded to, and refuted so ably by Ray, we would not have noticed the subject in this manner; but when it cannot be denied that the only interpretation to be put upon the former coincides so exactly with the latter, we think it our duty to guard our readers, and especially our younger readers, from unheedingly falling into a train of thought in which the fore-knowledge and harmonious contrivances of an all wise Creator, with reference to preconceived and intended uses, are virtually denied; attributes which it is expressly within the duty of the zoologist to hold up to contemplation and admiration, and which the objects of his study so continually present to his view.



Instances of structure dependent upon economy. A, fore leg of the mole cricket, formed for digging under ground, the articulated tarsus, *a*, being lodged in the groove, *b*, when in action. B, fore leg of a sand wasp, formed for burrowing in loose sand; the alæ, *a a*, being employed in brushing away the loose particles.

We have purposely abstained from entering into the arguments adduced by Ray in refutation of these atheistical opinions, the opposite view being fortunately too clear to need much argument in its support. He would be but a sorry architect who, having completed the building of a splendid palace, had not, previously to its erection, planned the uses of its various apartments, and adapted the size and situation of each to its intended uses.

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We have thus seen that it is by the continued accumulation of facts, and by noticing the adaptation of structure to habits, or, as Ray more quaintly styled it, the making of things to uses, that we obtain more decided chances of attaining to perfection in our systematic classifications. But we are enabled to do more than this. Natural history is not a mere science of system and names; we have living objects for our study. The student must, however, guard against both extremes. It is as erroneous to consider that person a true naturalist who contents himself with giving a series of hard names to a collection of dried insects or other objects, as it is to assert "that any person, with a little care, may become a tolerably good naturalist the first walk he takes in the fields, without much knowledge of books."

To observe well the habits and economy of animals, to notice, by the assistance of anatomical examination, the adaptation of structure dependent upon such habits, to have studied the writings of our predecessors who have pursued a similar mode of research, and to apply the information thus obtained to the discovery, not only of the systematic name, and the relationships, more or less remote, existing between the various species of animals, with reference to their arrangement in a natural system*, but also of their relationship with nature in general, the weight of each in the great scale of the universe, and the mutual dependence of animals or plants upon each other, which constitutes that mighty whole which St. Pierre has so well termed the harmony of nature; this it is which constitutes a knowledge of nature, and he, and he only, who will look at an insect or a plant in this manner,—he who will not rest contented with the possession of a specimen, or the observation of a fact in its economy, or the knowledge of its name and place in the system, but will give to his views this extent, he only is the good naturalist.

Having thus laid before our readers a notice of the various grades in the science of entomology, or rather, we might say, in any of the departments of zoology, together with what appears to us to be the most efficacious mode of pursuing the subject in each, we now purpose to trace, as concisely as possible, the rise of entomology, including a sketch of its present state.

The names of various celebrated men who have given from time to time an impulse to the science of entomology, or who have rendered to it the most signal services, mark the eras of the more remarkable periods in its history. This order, founded upon the growth of knowledge, is certainly preferable to that established upon the lapse of years from century to century.

Without dwelling upon the Book of Holy Writ, from whence it is evident that the Hebrews had a certain knowledge of the habits of various insects, and had distinguished a certain number of them, the first memorable era is that of Aristotle, since it is in

* Some persons have either wilfully or ignorantly confounded the mere methodical classification of animals, *i. e.* their system of names, with the natural system, than which no two things can be wider apart. Thus, in the former, that classification must be the best by which we are enabled with the least labour to arrive at the name of an animal; whereas perfection in the latter can only result from a knowledge and adoption of the numerous and intricate relationships existing amongst animals, whether of affinity (that close relation existing, for instance, between a hive bee and a humble bee,) or that more remote relationship termed analogy, of which an instance may be mentioned in the hornet, the hornet sphinx, and hornet asilus.

the writings of that father of zoology that the first traces of entomology, as a distinct science, are to be found. This era dates from three centuries and a half before the Christian era; and, as Latreille observes, it is not less memorable in the history of the world as being that in which one of his pupils, Alexander the Great, flourished; and, by a remarkable coincidence, the modern Aristotle (as Cuvier has been called) flourished during the reign of a man scarcely less celebrated than Alexander. Aristotle noticed the difference between mastieating and sucking insects, and many of the divisions which he established amongst insects are adopted by the latest entomologists; but the distinctive character of the science of entomology of this period was the admission of a greater number of insects as distinct species, which were but in the preparatory state of others, which were also observed. In like manner many species which had not been traced to the egg-state, were regarded as the offspring of a spontaneous generation. With insects were arranged the *Annelidæ* and many other animals of a widely different structure. Entomology was, however, at this period but a summary of popular traditions, often fabulous or in part erroneous, and more under the domain of medicine than of zoology, mixed up, nevertheless, with some facts which were too apparent to escape the simplest investigation. As to the other ancient naturalists, they have scarcely added any thing to the knowledge transmitted to them by Aristotle. This knowledge passed from the Greeks to the Romans, and from them to the inhabitants of the northern parts of Europe, by whom the Roman power was broken down. Pass we, therefore, over a period of nineteen centuries, and arrive at the second great entomological era when the revival of letters led to a corresponding revival of the so long dormant sciences. Albert the Great devoted one out of the twenty-two folio volumes, of which he was the author, to natural history, and in which he treated upon insects, which he separated from the crustacea. Half a century afterwards (about 1550) the simultaneous appearance of Gesner, Belon, and Rondelet, three of the fathers of zoology, gave a great impulse to this branch of science. Still, however, entomology was much infected with the radical vice of spontaneous generation, but the spirit of observation was abroad; facts were collected, and both by the assistance of figures engraved upon wood and of microscopic glasses, much increase was made to the stock of knowledge. Some naturalists even confined their researches to entomology; and in 1602, Aldrovandus published a treatise upon this science. In like manner, in the "Treatise of Insects," (an extensive folio volume, being the joint labours of Wotton, Gesner, Penny, and Mouffet, published in 1624, and being remarkable as the earliest work which appeared in England expressly devoted to entomology), a great variety of figures of insects were given, which from their rarity have been overlooked or regarded by modern writers as entirely novel. The work was divided into chapters, in each of which some genus of insects was treated upon; the first seven being devoted to the honey bee. Still, however, there were incongruously blended along with insects all sorts of larvæ of other species belonging to the winged orders, and likewise many of the Linnæan class of genuine *Vermes*, and even the *Hippocampæ*. Moreover, in the works of this period, we find the same continual reference to the supposed

medical virtues of almost every species of insect, an instance of which, showing the ridiculous extent to which these ideas were carried, has been given under our article *Curculionidæ*, in the account of the *Curculio antidontalgicus*. But better days were now at hand. Redi, and Malpighi, and Swammerdam, towards the close of the seventeenth century, laid the foundations of a true system of entomology by the excellency of their respective observations. The first of these celebrated men, by experiment, threw down the doctrine of equivocal or spontaneous generation, and also corrected numerous other errors into which naturalists in general had fallen. The second published a variety of researches of great importance upon the anatomy of these animals; whilst the third, by stripping from the transformations of insects all of the marvellous with which they had been invested, and more especially by the clearness of the details by which he illustrated the extraordinary and startling fact which he quaintly designated as "an animal within an animal," contributed more to the true knowledge and systematic distribution of insects than any of his predecessors. His work, as well as those of Mouffet, Redi, and Malpighi, are still sought after with avidity by the student; and his pages, although containing much verbosity, are filled with the most valuable materials—the result of the most patient attention, devoted both to the habits and structure of the animals investigated. If, indeed, in our days, the distribution which he proposed, founded upon the nature of the transformations of insects, has been abandoned, it is not less true that the considerations upon which it was established, constitute one of the most valuable elements for a classification of insects, according to their natural relations with each other.

About the same period Lister, Leeuwenhoek, madame Merian, Vallisnieri, and Ray, rendered great service to entomology by making known, in considerable detail, a great number of insects, whilst the *Memoirs of Reaumur*, which appeared about the middle of the eighteenth century, form a storehouse of facts to which every entomologist cannot but turn with new delight. De Geer also, the prince of entomologists as he has been termed by Macleay, flourished about the same period, and either as regards classification, anatomy, physiology, or the economy and habits of insects, his "*Mémoires pour servir à l'Histoire des Insectes*," written in French, although printed at Stockholm, cannot be cited without praise. There are other authors who have trod in the steps of these illustrious men, but up to the present time their labours have not been surpassed.

We now arrive at the era of Linnæus, a name to be revered by every naturalist. To him every branch of natural history, entomology, in particular, are under the greatest obligations for the strong impulse given to them. This is not the place to detail his classification of insects, valuable as it is, and purified from the errors with which the ancients had darkened the subject; but we must here pay the debt of justice and of gratitude for the admirable system of names which he invented, and which has now become general, for the clearness and precision of the definitions which he gave of the different orders of insects, for the establishment of genera, and for the promulgation of a code of philosophical precepts relative to natural history and botany.

The same era gave birth to other entomologists, whose works must be cited with praise—Rosel, Schaffer,

Frisch, all of whom have figured and described many insects. Bonnet, whose researches upon the habits and generation of *Aphides* are of the greatest interest; not only with respect to the natural history of these animals, but also to physiology in general. Lyonnet, to whose incomparable anatomical details upon the *Cossus* we have had occasion repeatedly to refer; Fabricius, also the pupil of Linnæus, by the vast number of new species of insects which he described, and the pains which he took in bringing to perfection a novel system of classification founded upon the structure of the organs of the mouth (that of Linnæus being built upon the structure of the wings), has merited the thanks of the entomologist.

Hitherto we have seen that in the distributions which had been proposed by entomologists, a single organ, or series of organs, had been selected as a key-stone of the system; the natural consequence of which, as might have been expected, was the constant artificial results to which such distributions were exposed.

We now arrive, however, at the era of the eclectic system, or that of Latreille, one of the most indefatigable and philosophical entomologists that has yet appeared, who perceiving this difficulty, successfully accomplished the task of remedying it. He did for entomology what his compatriot, Bernard de Jussieu, had succeeded in doing for botany. By making use of the various characters which are exhibited by various organs in various degrees of development in various groups of insects, and by neglecting neither the metamorphic characteristics (which were the key of Swammerdam's arrangement); nor the variations in the structure of the wings (upon which the Linnæan system was founded), nor the structure of the mouth (which Fabricius had employed as above stated), he has established amongst insects natural groups, arranged according to the affinities which they respectively possess with each other. His first work appeared in 1796; and since this period up to the present time, the works of entomologists in general have been directed towards the same end. Latreille himself, until his lamented decease, ceased not to strive to render his views more accordant with nature. Cuvier, by his admirable comparative anatomical researches; Dumeril, Lamarck, Savigny, Macleay, Kirby, Meigen, Schonherr, and a great number of other distinguished authors, have followed in the same steps, and have contributed to render the distribution of insects more perfect, and more easily applicable; or to complete our knowledge of groups by the publication of descriptions of new species, or of anatomical details of those already known.

In respect, therefore, to precision of observation, to the distribution of insects into natural groups, and the classification of such groups, it is to be observed, that in our own times the greatest progress has been made in entomology. Earlier classifications were founded upon individual and isolated characters, so that the groups which exist in nature were but vaguely exhibited; but at the present day, by the examination of the general characters of insects, all such as are allied together in nature are brought into contact, the effect whereof is, that it is sufficient only to obtain a complete knowledge of a single individual, in order to gain a clue to the general structure of the whole of the species which are arranged with it.

In like manner, the investigation of the internal anatomy of these animals has been equally progressive, for, instead of simply examining the structure of such

or such an isolated animal, entomologists, following in the steps of the comparative anatomists, have traced the modifications which each organ exhibits in the whole of the animals of which the class is composed. Cuvier led the way to this branch of the science, and has been followed by Marcel de Serres, Herold, Treviranus, Leon Dufour, Gaede, &c.; whilst the minute researches of Straus-Durckheim upon the *Melolontha vulgaris*, and of Mr. Newport upon the Privet Hawk Moth, published in the "Philosophical Transactions" for the last year, may be cited as models of patience. Besides the last named author, the English entomologist may boast of the works of several other labourers, whose researches are not inferior to those of any of the continental authors. The "Illustrations of the Genera of British Insects," published by Mr. Curtis, is a work of the highest service to the science, displaying not only the most minute care in the dissection and delineation of the typical species of the genera illustrated, but also the highest style of elegance in its pictorial representations; whilst the work of Mr. Stephens, which may be regarded as a companion to the former, presents to us a far more complete series and description of the species of insects found in our own island than any other country can boast of. The "Systematic Catalogue" of the latter author is a work exhibiting the most astonishing exertion; whilst the completion of Mr. Haworth's *Lepidoptera Britannica*, the *Australian Monographs* of Mr. George Gray, with beautiful illustrations from the pencil of Mr. Charles Curtis, the English translation of the "Règne Animal," by Mr. Griffith and others, the work upon the *Lepidoptera* of Java, by Dr. Horsfield, together with numerous valuable memoirs published in the "Magazine of Natural History," the "Annals of Philosophy," Dr. Jameson's *Edinburgh Journal*, the *Linnæan and Zoological Society's Transactions*, the *Entomological Magazine*, and the *Transactions of the Entomological Society of London*, all prove that the spirit of entomology is rising strongly amongst us.

In the last place we may mention, as affording a most gratifying fact in the history of the science of entomology, the recent establishment of societies expressly devoted to the cultivation of this branch of zoological knowledge, both in Paris and London. England, it is true, led the way by the establishment of such a society nearly forty years ago, for the support of which the best energies of the late Mr. Haworth were in an especial manner, and for a great length of time directed; but for the last twenty years nothing had been done by it. It must, however, be admitted, that it is to the establishment of the French Entomological Society of London that we may, in a great degree, attribute the rousing of the energies of the many entomologists amongst us: the result of which has been the formation of a society established upon liberal principles, and likely to prove of the greatest service to the science, for the cultivation of which it has been called into existence. See further the articles *INSECTS*, *ARACHNIDA*, and *CRUSTACEA*, and the articles referred to in each.

ENTOMOSTOMATA (De Blainville). These molluscs form the second family of the first order *Siphonostomata*, second class *Paracephalophora*. The family includes the genera *Buccinum*, *Cerithium*, *Melanopsis*, *Planaxis*, *Subula*, *Terebra*, *Eburna*, *Harpa*, *Dolium*, *Cassidaris*, *Cassis*, *Ricinula*, *Cancellaria*, *Purpura*, and lastly *Concholepas*, nearly all of which were

blended together by Linnæus in his genus *Buccinum*. As each of these genera will be described in their alphabetical order, a more detailed account will be here needless. The general character of the genus, as respects the animal, has already been given under the article *Buccinum*.

ENTOMOSTRACA (Müller). One of the two principal sections into which the class of crustaceous animals is divided by Müller, Latreille, and other entomologists. By Linnæus, the animals comprising this division, and which are chiefly of small size, were principally arranged in the genus *Monoculus*; but the researches of various more recent authors, Schaffer, Jurine, Ramdohr, Straus, Herman, and others, have shown not only that these animals constitute various different genera, but also orders and families. They are aquatic animals for the most part, inhabiting fresh water. Some of the species, however, including the king crabs (*Limulus*, which is by far the largest species in the section) are marine. Their legs, of which the number varies, sometimes reaching more than a hundred, are well adapted for swimming, being, indeed, only employed for that purpose, for which end they are either ramified or split, or else composed of flattened joints. The branchiæ, consisting of hairs or setæ, either isolated or united, forming pencils, are attached to the legs, or to certain of them, or to the upper or lower jaws. The shell covering the greater portion of the body consists of one or two divisions, and is very slender, being often membranaceous and diaphanous. The integuments of the body are rather corneous than crustaceous, in which respect they approach the insects rather than the true crustacea. The mouth is very variable in its construction, consisting either of jaws as in the *Branchiopoda*, or of a sucker as the *Pæcilopoda*, the majority of which latter order are parasitic upon various species of aquatic animals. The young of the *Daphniæ* and some other allied genera, at their exclusion from the egg, scarcely differ, except in size, from their parents; whereas the *Cyclops*, the *Phyllopodæ*, and *Argulus*, undergo decided transformations, both in the form of the body and the number of locomotive organs; indeed, in the latter organs the uses as well as the number are altered in the passage to the adult state. The antennæ of the *Entomotraca*, of which the form and number are very variable, are occasionally employed in locomotion. The organs of generation are situated at the base of the articulated abdomen or tail, which is never, however, terminated in an apparatus for swimming, nor furnished with appendages in its lower surface, as in the crabs and other *Malacostraca*. The eggs are either carried within the shell upon the back, or are external and borne beneath a common envelope in one or two masses at the base of the tail. In some species the eggs are capable of sustaining a long continued desiccation without losing their vitality. It is not until after the third moulting that they become adult and capable of reproduction. In a few instances it has been observed, that, as in the *Aphides*, a single impregnation is sufficient for several successive generations.

This section is divided into two orders, *Branchiopoda* and *Pæcilopoda*, which see, as well as the divisions there referred to, and also the general article **CRUSTACEA**.

EOLIDA, or **EOLIS** (Lamarck). A molluscous animal, without any testaceous protection. The body of the animal is oval, oblong, like that of a snail, gasteropod; the head very distinct, with two or four

superior tentacula, besides two labial; the branchia are formed of a great number of small soft flexible scales, imbricated on each side of the back. The *colis* is one genera of the first family *Tetracerata*, second order *Polybranchiata*, second class *Paracephelophora*.

EPACRIDEÆ, a natural order of dicotyledonous plants, containing between twenty and thirty genera, and upwards of one hundred and twenty species. It is closely allied to *Ericææ*, or the heath tribe, and differs from it only in its anthers being one-celled, and not furnished with appendages.

The essential characters of the order are: calyx five, rarely four-parted, often coloured and persistent; corolla hypogynous, monopetalous, the tube sometimes five-parted, the limb five, rarely four-cleft, sometimes bursting transversely, in consequence of the cohesion of the segments, deciduous or withering; its æstivation valvate or imbricated; stamens generally equal in number to the segments of the corolla, and alternate with them; filaments inserted on the petals or hypogynous; anthers simple, with a single receptacle of pollen; ovary sessile, usually surrounded at the base with five distinct or connate scales, and generally many-celled; ovules solitary or indefinite; one style; stigma simple, or sometimes toothed; fruit either a drupe, a berry, or a capsule; seeds with albumen.

The plants belonging to this order are shrubs or small trees, which are often covered with simple hairs. Their leaves are alternate, rarely opposite, entire, or serrated, often stalked; their bases sometimes dilated, overlapping each other, and half-sheathing the stem. Their flowers are white or purple, sometimes blue, and grow in spikes or terminal racemes, or are rarely solitary and axillary.

They are all natives of New Holland and the islands of Polynesia, forming a striking feature in the vegetation of those parts of the globe. They may be said to occupy in Australia the place which the heaths do at the Cape of Good Hope. Many of the species are remarkable for the beauty of their flowers, and are on that account prized in greenhouses. Some of them yield edible fruits, but in general their properties are not known.

The order has been divided into two sections: 1. The true *Epacrideæ*, including the genera *Epacris*, *Sprengelia*, &c., in which the cells of the ovary are many-seeded, and the pericarp capsular. 2. *Stypheliæ*, comprehending the genera *Styphelia*, *Lissanthe*, *Leucopogon*, &c., in which the cells of the ovary are one-seeded, and the pericarp indehiscent, rarely capsular.

The fruit of *Leucopogon Richei* supplied food to the naturalist Riche when he was nearly perishing from hunger in Southern Australia. The fruit of *Lissanthe sapida* is one of the few edible fruits of New Holland. It is of a red colour, and is as large as a black currant, having something of the consistence and taste of the Siberian crab. It is sometimes called the Australian cranberry.

EPEIRA (Walckenaer). A genus of spiders, comprising the largest and best-known British species, *Epeira diadema*, a handsomely marked species, observed in autumn suspended in its web in our gardens. We are induced therefore in this place to make a few general observations upon the order of which the spider is the type, and which were accidentally omitted in our alphabetical arrangement.

As already stated in the articles *Arachnida* and *Aptera*, the different species of spiders were placed by Linnæus in the genus *Aranea*, constituting the 8th of the order *Aptera*. These insects having, with some genera of less importance, been raised by modern naturalists into a class of equal rank with the crustacea and true insects, the Linnæan genus *Aranea* may now be considered as equivalent to an order, to which Latreille gave the name of *Fileuses* or *Spinners*, Macleay that of *Araneidæ*, and Leach that of *Dimerosomata*. The name of *Aranea* has not, however, been dropped, but has been employed to denominate the modern genus, consisting of the domestic spider *Aranea domestica* of Linnæus, and which may be regarded as the type of a group of genera to which we have applied the family name of *Araneidæ*, corresponding with the *Araignées sédentaires tubitélés* of Latreille, or those species of spiders which spin irregular webs, having a cylindric cell in one corner in which the inhabitant lurks for its prey. The spinnerets are cylindric, placed close together in a star and directed backwards, the legs are strong, the first or the last pair being the longest in some, whilst in others the legs are of nearly equal length. This family comprises the genera *Clotho*, Walckenaer; *Drassus*, Walckenaer; *Segestria*, Latreille; *Clubiona*, Latreille; *Aranea*, Latreille; (*Tegenaria*, Walckenaer;) *Agelena*, Walckenaer; *Nyssus*, Walckenaer. Latreille has also introduced the water spider, *Argyro-neta*, into this group; but the Baron Walckenaer has formed it into a distinct family, which he terms *Naiades*, or *Aquatiles*.

The other groups of spiders may be arranged as follows:—

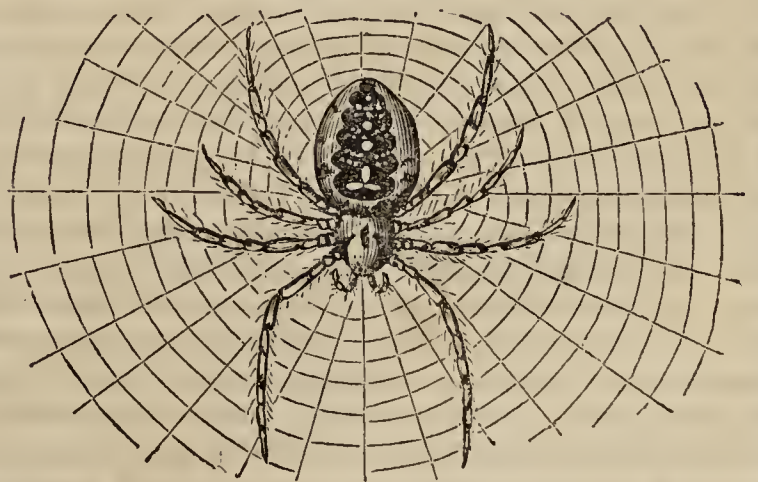
Section 1. *Tetrapneumones*, or those which have four pulmonary sacs and four external spiracles on the under side of the abdomen, (two on each side placed closely together,) and comprising the families of *Mygalidæ* (the gigantic bird spiders, as they have been erroneously termed, of tropical countries,) *Atypidæ* and *Dysderidæ*. (See *ATYPUS* and *DYSDERA*.)

Section 2. *Dipneumones*, or those which have only two pulmonary sacs and two external spiracles, comprising the majority of the order, and divisible according to the manner of construction of the web into the families *Araneidæ* described above; *Theridionidæ*, comprising sedentary species which make an irregular web without any tubular retreat; *Epeiridæ* (described below); *Thomisidæ*, hunting spiders possessing the power of walking sideways; *Lycosidæ*, wandering spiders catching their prey whilst walking about, and not making a web, except for the reception of the egg; and lastly the *Salticidæ*, differing from the latter in the agility with which they leap upon their prey from a considerable distance.

The family of the *Epeiridæ*, or the *Araignées sédentaires orbitélés* of Latreille, make their webs in a regular net, composed of a series of concentric circles, crossed by straight lines diverging at equal distances from the centre, where they in general station themselves head downwards. Some species hide themselves in a hole which they have formed near the edge of the web, which hole is either

horizontal or perpendicular. The eggs are glued together and concealed in a large silken cocoon. The spinnerets are somewhat conical, convergent, and arranged in a rosette; the legs are slender, the lower jaws are straight and thickened at the tips; the first pair of legs are the longest, and then the second pair. The eyes are disposed as follows: four in the centre, occupying a quadrilateral space, and two on each side. The genera are *Linyphia*, *Uloborus*, *Tetragnatha*, and *Epeira*.

In the genus *Epeira* the four middle eyes are arranged in a square, and the other four are placed in pairs on each side. The hooks of the jaws are folded along their internal surface, and the spinnerets are but slightly exerted. These spiders live separately, each individual forming its own web, which in some of the large exotic species, as the *Epeira clavipes*, a native of the West Indies, is sufficiently strong to hold small birds, which may by accident be caught in it; those of our own country are capable of retaining insects of considerable size, which form the prey of the spider; for this purpose they are suspended vertically between the branches of trees or plants, or in other open spaces frequented by insects: occasionally they are placed obliquely, and even horizontally, as in the *Epeira cucurbitina*. No sooner is a fly or other insect caught in the web, than it is approached by the spider, which in a curious manner envelops it in a silken shroud, by placing the tips of its fore legs, at each extremity of the insect's body, so as to form the points of an axis, round which the insect is whirled with rapidity, a dense layer of silk being at the same time thrown round it from the spinnerets. This genus is very numerous in species: M. Walckenaer mentions sixty-four species in his Table of *Araneides*, generally remarkable for the variety of their colours, forms, and economy. Of these many of the exotic species are remarkable for the singular spines and teeth with which they are armed.



Epeira diadema.

The best known English species is the *Epeira diadema*, which abounds in our gardens in the autumn, and which has received its name from the elegant markings of a pale colour upon the upper side of its dark-coloured abdomen. The female places her cocoon of eggs in retired corners of walls and similar situations, the young are excluded in the following spring.

We must refer to our article *SPIDER* for a general account of the mode in which the webs of these insects are constructed, and for other details relative to their economy.

EPHEDRA (Linnæus). A curious genus of plants

belonging to the natural order *Coniferae*. Two of them are hardy European dwarf bushes, the other is a climber from Barbary. They are propagated by layers or suckers.

EPHEMERA (Linnæus.) A genus of neuropterous insects, belonging to the section *Subulicornes* of Latreille, and forming the type of the family *Ephemeridæ*, distinguished by the entirely membranous and almost obliterated structure of the mouth, the parts of which are very indistinct, the five jointed tarsi, the small size of the lower wings, which are even sometimes entirely wanting, and the slender threadlike appendages with which the tail is terminated.

The name of this genus has been given in consequence of the very short duration of the life of the insect when arrived at the perfect state, it is derived from the Greek, and signifies living only through a day. The insects are the may-flies of anglers, whose beautiful motions in the blaze of the evening sun, alternately rising and falling, cannot have failed to have attracted the notice of every observer of nature. The body is soft, long, and slender. The antennæ are very short and three jointed, the wings are generally carried either perpendicularly, or slightly inclined. The legs are long and slender, without bristles, the anterior pair being the longest, inserted close to the head, and stretched out in front of the body. The perfect insects generally appear in swarms about sunset, in fine summer or autumn evenings, along the margins of streams, lakes, &c., and occasionally in such numbers, that the ground is shortly afterwards so completely covered with their dead bodies, that in certain districts they are collected in cart loads, and used as manure. One species, *Ephemerella albigenu*, is remarkable for the whiteness of its wings, so that its swarms have all the appearance of a fall of snow. It appears to have been this species, the proceedings of which are detailed by Mr. A. H. Davis, in the Entomological Magazine, and whose account, as illustrative of a remarkable peculiarity in the economy of the insects of this family, we here insert:—"On a fine evening, towards the latter end of May, I was collecting in the neighbourhood of Brixton, near some ponds, when I was suddenly covered by a multitude of small species of ephemera. They settled on me, apparently from my being the most conspicuous object near, on which to undergo their final transformation. Their colour was of a dusky white and opaque. They retained their position, without moving, enabling me to observe beneath the glass the process by which these fragile creatures withdraw themselves from the comparatively cumbrous garment which envelopes their beautiful and aerial form. Immediately on settling, the wings were laid flat at right angles with the body, and the insect remained about half a minute in a state of repose. A slight motion then appeared about the basis of the wings, which gradually collapsed, and were drawn alongside the abdomen. At this moment the insect resembled a piece of dirty cotton-wool, with little form. The elevated portion of the thorax now distended, and then gave way longitudinally, exhibiting the bright brown thorax of the insect, which was rapidly followed by the head and anterior legs. After this effort, the insect rested a few seconds. The next discernible motion was in the two or three last segments of the abdomen, where the muscles were in violent agitation, evidently for

the purpose of extricating the fine setæ which adorn that part. The contractions continued upwards, and the wings, freed from their flimsy covering, were fully developed, and in an instant the delivered captive took its flight; the whole process strongly resembling the drawing off of a tight glove. The whole operation did not, in most cases, exceed three minutes; in some cases less. Scarcely an instant elapsed between the full development of the insect and its taking flight, so rapidly did they acquire consistency. In some few instances I observed them coupled, in which case they soon died. I made a dozen or so find their way into a phial; they instantly deposited their eggs, and died; one only, which I believe was a male, survived when I reached home, less than one hour after.

"The number of the insects was truly surprising, they covered every part of my apparel, and my face and hands were not exempt. On my arrival at home, my hat looked like a miller's, from being completely covered with exuviae. I had taken several of these insects during the evening, and had put them into pill boxes; almost all, however, were immature, and died without undergoing their metamorphosis, from which it would appear that light and a free atmosphere are essential to its accomplishment. The principal swarm, however, appeared about an hour before sunset, and enjoyed their hour's existence in one of the finest sunsets of this glorious summer."

The singular circumstance of these insects undergoing a shedding of the outer skin, after they have arrived at their winged state, is an apparent exception to the general rules of insect metamorphoses. It is, however, to be observed, that many insects appear, on bursting from the pupa state, to be enveloped in a delicate membrane, which is immediately burst and thrown off. This has been often observed by persons who rear lepidopterous insects, and it appears to us that this envelope of the ephemera is perfectly analogous to the pellicle of the moth, being however, from its former consistence, retained longer by the insect.

On arriving at the perfect state, the only operation which these insects have to perform is the propagation of their race, the imperfect and rudimental structure of the mouth preventing their taking any nourishment in this state. The female, immediately after impregnation, deposits her eggs in a mass in the water.

But although the may-fly lives only a very short time when it has attained the winged state, its existence in the larva and pupa states has been much longer, sometimes lasting even two or three years. During this period it resides in the water, often concealed during the day beneath stones or in holes, and sometimes in horizontal burrows divided internally into two canals, each having its own orifice. These burrows are always formed in clayey soils, covered by the water, which penetrates its cavities, and it has been supposed that it is upon this soil that the larva feeds. These larvæ differ from the perfect insect, not only by being destitute of wings, but in several other particulars. The antennæ are longer, the simple eyes are wanting, the mouth is provided with a pair of corneous jaw-like appendages, the abdomen is furnished on each side with a series of leaf-like plates, ordinarily disposed in pairs, at the base of which are a kind of false branchiæ or gills, upon which the tracheæ are laid out in a branching direction, and

which serve, not only as organs of respiration, but also of locomotion, being moved with facility. The tarsi have but a single claw. The extremity of the body is furnished with several short ciliated filaments. The pupa differs only from the larva in having rudiments of wing covers.

One of the species, which, from its abundance, has been termed *Ephemera vulgata*, is well known to the angler as a famous bait for the trout. It appears in May and June. Gilbert White says of it:—"June 10, 1771—Myriads of May flies appeared for the first time on the Alresford stream. The air was crowded with them, and the surface of the water covered. Large trouts sucked them in as they lay struggling on the surface of the stream, unable to rise until their wings were dried. This appearance reconciled me in some measure to the wonderful account that Scopoli gives of the quantities emerging from the rivers of Carniola. Their motions are very peculiar, up and down for many yards almost in a perpendicular line."

The number of species of this family ascertained to be inhabitants of this country is about fifty, the majority of which are as yet undescribed. They are divisible into generic sections, from the number of wings and caudal filaments, as follows:—

Genus *Bactis*, Leach; filaments 2; wings 4. Type, *E. biloculata*, Linn.

— *Cloeon*, Leach; filaments 2; wings 2. Type, *E. diptera*, Linn.

— *Ephemera*, Linn.; filaments 3; wings 4. Type, *E. vulgata*, Linn.

— *Brachycercus*, Curt.; filaments 3; wings 2. Type, *E. brevicauda*, Fab.

We presume that the latter genus was intended to have been named *Macrocerus* (long-tailed), instead of *Brachycercus* (short-tailed), the tails in the typical species being exceedingly long. The largest species in the family is the *Ephemera Swammerdamiana*, being that whose transformations and anatomy were described by Swammerdam. It belongs to the genus *Bactis*, if indeed it be not the type of a distinct genus, as its large size seems to indicate. The largest British species of the family is the common may-fly described above.

EPIDENDRUM (Linnæus). A rather extensive and curious genus of plants, belonging to the natural order *Orchideæ*. Generic character: sepals free, spreading, labellum clawed, claw united to the tube of the column; the lip often three-lobed; pollen masses parallel. This genus, like all the rest of the order, are remarkable plants. One section of the epidendra has a kind of gouty stems, which are neither bulbs nor tubers. Another section is destitute of these swollen stems, and is more terrestrial than the others; some of which are epiphytes, living on the stems of trees, and when removed will preserve their vitality for a considerable time, and flourish suspended by a string without either earth or condensed water; hence they are called air plants.

EPIGŒA (Linnæus). A small creeping plant found in North America. It belongs to the tenth class of Linnæan botany, and to the natural order *Rhodoraceæ*. It is a hardy plant, and thrives well in our common borders.

EPILOBIUM (Linnæus). A genus of herbaceous plants, mostly perennials and natives of Europe. Class and order *Octandria Monogynia*, and natural order *Onagrariceæ*. One of the most common is the willow

herb, often seen in shady places in hedge banks; nine others are natives of Britain.

EPIPACTIS (Richard). A genus of two orchideous plants, both natives of Britain, found in most woods and marshes. The *E. latifolia* was formerly called *Serapias latifolia* by Linnæus. They are admitted into the flower garden, where they thrive much better than many other wild orchises.

EPIPHYLLUM (Haworth). A genus of remarkably showy succulent plants separated from the genus *Cactus*. The flowers are icosandrious, and the plants belong to the natural order *Opuntiaceæ*. These plants are leafless, but the stems are dilated into leaf-like forms, and bear their splendid crimson flowers on the edges. They require a dry compost of a little loam and lime rubbish. The pots should be small and well drained, the plants needing but little water. They are readily struck from cuttings, which should be laid to dry for some time before they are planted.

EPOMIS (Bonelli). A handsome genus of coleopterous insects, belonging to the section *Pentamera*, family *Carabidæ*, and sub-family *Harpalides*, separated from *Chlænus*, to which it is very closely allied, by having the maxillary palpi terminated by an elongated hatchet-shaped joint, which is more dilated in the male than in the female; the lower lip has a bifid tooth in the centre. The type of this genus, of which there are but very few species, is the *Carabus circumscriptus*, two or three specimens of which existed in the old British collections.

EQUISETACEÆ—the horse-tail family. A natural order of acotyledonous or cellular plants, containing only one genus, but numerous species. This is a remarkable order of plants, having little affinity with any other tribes. It may be said to approach the *Cycadeæ* and *Coniferæ*. It resembles the fern-tribe in the want of the sexes and the presence of annular ducts without spiral vessels; while its germination is similar to that of mosses.

The essential characters of the order are: fructification terminal, in spikes or catkins, consisting of many-sided, shield-like scales, on the lower side of which are from four to seven involucre. These open longitudinally, and contain numerous round bodies having at their base four elastic club-shaped filaments, twisted spirally round them when dry, but expanding when moistened.

The plants belonging to the order are branched and leafless. Their stems are rigid, streaked, and hollow, and consist of several easily separated joints, each of which is surrounded by a membranous toothed sheath. Under the cuticle a quantity of siliceous or flinty matter is secreted. The branches are mostly in whorls.

The *Equisetaceæ* are widely dispersed over the globe, and generally grow in moist, marshy places. None of the species have as yet been found in New Holland. It would appear from the fossil remains discovered, that a great part of the original vegetation of our globe consisted of gigantic equisetums several yards long, much larger than any of our present species, which have generally weak stems, and seldom exceed three or four feet in height.

Equisetum is the only genus of the order. It includes numerous species, and some of which were formerly used medicinally as astringents and diuretics. From the quantity of flinty matter which they contain, they are used for various domestic purposes, such as polishing furniture. The flint in the living

plants amounts sometimes to thirteen per cent., and the ashes of the plants have been found to contain half their weight of that mineral.

Equisetum hyemale, (rough horse-tail), contains so much silex or flint, that its vegetable matter has been removed, and yet its form has been retained. It is used for the polishing of hard woods, brass, ivory, &c., and may be made to act as a file. In Northumberland, the dairy-maids use it to scour and clean their milk-pails. The plant is imported largely from Holland under the name of Dutch rushes.

On subjecting a portion of the cuticle of this plant to the analysis of polarised light under a high magnifying power, Sir David Brewster detected a beautiful arrangement of the siliceous particles, which are distributed in two lines parallel to the axis of the stems, and extending over the whole surface. In general the particles form straight lines, but sometimes they are grouped in oval forms, and connected together like the beads of a necklace. Many of the particles do not exceed the five-hundredth part of an inch in diameter. From the observations which he made, Sir David Brewster concludes, that the crystalline portions of silex are not foreign substances of accidental occurrence, but are integral parts of the plant itself, and probably perform some important function in the processes of vegetable life.

The fronds of *Equisetum arvense* are said to be hurtful to such animals as feed on them in autumn. *Equisetum fluviatile* was eaten by the common people among the Romans. It is said to be eaten by reindeer, and is used in some countries as food for cattle.

The seeds of the *Equisetums* possess hygrometrical properties: when exposed first to a dry and then to a moist atmosphere, they move about in various directions, according to the lengthening or shortening of the thread-like processes which are attached to them.

ERANTHEMUM (R. Brown). A genus of ornamental under-shrubs, chiefly tropical. Linnæan class and order *Diandria Monogynia*, and natural order *Acanthaceæ*. Generic character: calyx of four equal parts; corolla salver-shaped, limb five-cleft, nearly equal; stamens four, two of which are abortive, two fertile ones protruding. This is a free flowering genus in our stoves, thrives in a light rich soil, and is easily increased by cuttings.

ERANTHUS (Salisbury). This is the *Helleborus hyemalis* of Linnæus, and remarkable as being one of the first flowering plants of the early spring, preceding both the snowdrop and crocus. It is a polyanthous plant, and belongs to the natural order *Ranunculaceæ*. It is the winter aconite of English authors.

EREMURUS (Bieberstein). A genus included in the natural order *Asphodelææ*, and called *Asphodelus Altaicus* by Pallas. It is a herbaceous perennial, indigenous to Siberia, and has a place in our flower borders.

ERIA (Lindley). An orchideous genus, thought to be a *Dendrobium* by Dr. Hooker, but made a separate genus by Dr. Lindley. It receives its name from the extreme woolliness of the flower. Grown in turfy moor earth, and propagated by dividing the root.

ERIANTHUS (Michaux). A genus of gigantic grass, native of North America. It was supposed to be a species of *Saccharum* by Persoon, but Michaux's name is adopted.

ERICA (Linnæus). Heath. One of the most numerous families occurring in the vegetable kingdom.

Five hundred and forty-three species are named in published lists, besides numerous varieties. See **ERICEÆ**.

ERICEÆ, or **ERICINEÆ**. The Heath Tribe. A natural order of monopetalous dicotyledonous plants, containing nearly thirty genera, and upwards of nine hundred known species. The order is allied to *Vaccinæ* and *Campanulaceæ*, from both of which it differs in its superior ovary. It also bears an affinity to *Epacrideæ* and *Pyrolaceæ*, but is distinguished from the former by the structure of its anthers, and from the latter by its general habit, and the structure of its seeds.

Its essential botanical characters are, calyx persistent, inferior, four or five cleft; corolla hypogynous, four or five cleft, withering; stamens definite, equal in number to the segments of the corolla, or twice as many, inserted at the base of the calyx of the corolla; anthers two-celled, the cells hard and dry, separated either at the apex or base, where they are furnished with an appendix, and usually opening by pores; ovary free, surrounded at the base by a disk or by scales; one straight style, and a single undivided or toothed stigma; fruit capsular, many celled, with central placentas; seeds indefinite, minute.

The plants belonging to this order are shrubs, or under-shrubs, with evergreen, rigid, entire leaves without stipules. They cover immense tracts of country at the Cape of Good Hope, where upwards of three hundred separate species are found. The common heaths, or heather, form a considerable portion of the vegetation of large districts in England and Scotland. Heaths abound also in many parts of Europe, as well as in North and South America, both within and without the tropics. They are not common in Northern Asia or India, and in Australia they are scarcely known, their place being supplied by plants belonging to the order *Epacrideæ*.

In general the heaths possess bitter, astringent, and diuretic properties. The chief genera of the order are *Erica*, *Caluma*, *Andromeda*, *Ledum*, *Rhododendron*, *Azalea*, *Arbutus*, *Menziesia*, *Kalmia*, and *Gaultheria*.

Of the genus *Erica*, or true heath, there are five species indigenous in Britain: *Erica tetralix*, cross-leaved heath; *Erica cinerea*, five-leaved heath; *Erica Mediterranea*, *vagans*, and *ciliaris*.

The two first species, along with common ling, abound in all our moors, and are the badges of the clans of Mac Donald and Mac Alister. From the five-leaved heath the Picts used to make a delicious and wholesome liquor. In the following lines the poet alludes to this ancient practice, when he addresses this heath as,

Sweet, modest flower, in lonely deserts dun,
Retiring still for converse with the sun,
Whose sweets invite the soaring lark to stoop,
And from thy cells the honeyed dew-bells seep!
Though unobtrusive all thy beauties shine,
Yet boast, thou rival of the purpling vine!
For once thy mantling juice was seen to laugh
In pearly cups, which monarchs loved to quaff;
And frequent wake the wild inspired lay,
On Teviot's hills, beneath the Pictish sway.

At the end of the last century, this tribe of plants consisted of three or four British shrubs, and a single Spanish one, but when the Cape of Good Hope fell into the hands of the British, an amazing number of species were immediately discovered. At the present day, the species, and the varieties produced by

cultivation, are almost endless. All the species are remarkable for their beauty, their elegance, or the fantastic forms which they assume, and some are prized for their perfume. The cultivation of them is attended with a considerable degree of difficulty, but they have been reared with great success in Britain. They are propagated by cuttings and seeds, which are planted in a peat soil, having a considerable mixture of sand. They do not require a warm climate in winter; it is sufficient if they are protected from frost. A great deal of light and air, and a regular supply of water, are necessary for their vigorous growth.

Callemma vulgaris, common heather or ling, is abundant on all the moors in this country. In the Highlands the plant is put to many important uses. It is extensively used for thatching cottages, and for making brooms. The Highlanders frequently make their beds with it, laying the root downwards and the top upwards. It supplies materials for fuel, and for making ropes, and is employed also for dyeing and tanning. It forms an excellent edging for garden plots, and bears clipping well. From its flowers bees extract a large quantity of honey, which, although of a dark colour, is remarkably wholesome and nutritious. Heather affords shelter to many birds, and its seeds form the principal food of grouse. For this purpose the seed vessel is so constructed that the seeds are preserved for a year, or longer.

Arbutus, or *Arctostaphylos uva ursi*, red bearberry or whortle-berry, is an evergreen trailing shrub, abundant in the Highlands of Scotland, as well as in the north of England and Ireland. It bears small red, austere, and mealy berries, which are much eaten by moor fowl. The leaves have a styptic bitterish taste, and possess tonic, astringent, and diuretic properties. They are used medicinally in calculous or gravelly complaints, and in some diseases of the bladder. They have also been recommended in dysentery, and in consumption, combined with bark and opium. They may be administered either in powder or in infusion. The infusion made with cold water strikes a beautiful blue with persulphate of iron, in consequence of the large quantity of gallic acid which it contains. Besides this acid, the leaves contain tannin, resin, gum, extractive, woody matter, chlorophylle and water. When digested with alcohol they form a green tincture, which is rendered turbid by water, and when filtered passes through transparent and yellow, leaving a green resin on the filter. In some parts of Russia the plant is used for tanning.

Arbutus, or *Arctostaphylos alpina*, black bearberry, is another indigenous plant of this order, found on Ben Nevis, and many other Highland mountains. It is a trailing shrub, with elliptical leaves, which become in autumn of a fine red colour. The flowers are pale rose-coloured, and are succeeded by black berries, having something of the flavour of black currants.

Arbutus unedo, strawberry tree, the *arbutus* of Virgil, is a beautiful evergreen, indigenous about the lakes of Killarney in Ireland. In Crete and the Levant it becomes a bushy tree of very great size. From the beauty of its foliage this tree adds greatly to the claims of the lake scenery of Killarney. It is now a common ornament in our gardens, where it sometimes attains the height of eighteen or twenty feet. In the Botanic Garden of Edinburgh some specimens of the plant may be seen, which, under the care of Mr. Macnab, the able superintendent, have attained a size

and vigour scarcely equalled in this country. The tree bears pale greenish-white flowers, which are succeeded by red berries the size of cherries, and resembling strawberries in appearance. The fruit, which takes a year to ripen, is used as an article of food in Ireland and the south of France. When taken in too large a quantity it is said to act as a narcotic. In Corsica an agreeable wine is prepared from the berries. Several varieties of the plant are met with in nurseries, one with deep red flowers, called scarlet arbutus, another with double greenish flowers and narrow leaves, and a third with entire leaves.

Arbutus andrachne, oriental arbutus, and *Arbutus hybrida*, mule arbutus, have also been introduced into cultivation in Great Britain as ornamental shrubs.

Andromeda is another genus of this order, of which numerous species exist in America. *Andromeda polifolia* is found in marshy places in various parts of Britain. It is a small evergreen shrub, with rose-coloured drooping flowers, which are much concealed by the leaves. It sometimes receives the name of wild rosemary. *Andromeda hypnoides* is a moss-like plant which covers great tracts of ground in the Lapland alps, producing showy red flowers. The shoots of *Andromeda ovalifolia* have been known to poison goats in Nepal. From one of the species a volatile stimulating odoriferous oil is obtained which is used by the Japanese for the cure of rheumatism.

Rhododendron is a genus familiar to all on account of the beautiful species which are commonly cultivated in gardens. *Rhododendron chrysanthum*, yellow or golden flowered rhododendron, is a small plant which grows on the highest part of the snow covered mountains of Siberia, and is employed as an article of materia medica. Its leaves in powder or infusion, from their soporific and narcotic effects, are used as remedies in gout and rheumatism. In large doses they produce vomiting and delirium. From the effects produced by the infusion, it is called intoxicating tea in Russia. In this country the plant is scarcely ever employed now-a-days. *Rhododendron Ponticum* and *maximum* possess poisonous properties. *Rhododendron ferrugineum* and *hirsutum* are common on the high mountains of Switzerland, and terminate woody vegetation as we ascend. They furnish fuel to the shepherds, and grouse are said to eat them. *Rhododendron Caucasium* grows on the highest parts of Caucasus, near the limits of perpetual snow.

Azalea procumbens is found plentifully on the summits of most of the Scottish highland mountains, and abounds in the arctic regions. It is a low shrub, with a woody stem and crowded leafy branches. It has astringent properties. *Azalea Pontica* is a poisonous species. The honey collected by bees from the flowers of this plant is said to have poisoned some of the soldiers in the retreat of the ten thousand through Pontus.

Kalmias are beautiful peat-earth shrubs found chiefly in America. *Kalmia latifolia*, a native of Carolina and other parts of North America, grows on rocks hanging over rivulets, and on the sides of barren hills. It is one of the most elegant shrubs, and is prized both for the beauty of its foliage and the colour of its flowers. Unfortunately its poisonous qualities lessen in some degree the esteem which its beauty claims. An ointment made of the powdered leaves has been used in some obstinate cutaneous affections. The wood of the plant is hard, and well fitted for various domestic purposes. The brown powder which adheres

to the leaf-stalks of almost all the species of *Kalmia*, *Andromeda*, and *Rhododendron*, as well as that which surrounds their seeds, is used by the common people in the United States of America to excite sneezing. An infusion of *Gaultheia procumbens* is used as tea in North America. It is stimulating, and somewhat anodyne. The berries are succulent and esculent, and are sometimes infused in brandy, which is then used like common bitters. *Ledum palustre* is astringent, and when used in the manufacture of beer renders it heady.

Menziesia cærulea is a small shrub, found in a single station in Scotland, but frequent in America. It produces beautiful large purple-blue flowers, and is well worthy of a place in our gardens. Another species, *Menziesia polifolia*, is indigenous in Ireland, and is frequently cultivated.

This order, we have thus seen, is more distinguished for the beauty of the plants which it contains, than for the uses to which they are applied. Under it are included many of the most valuable green-house productions, and to it also is referred the heather-bell

That breathes the mountain air,

and which gives, in some degree, to the hills of Scotland their wild and romantic character.

ERIGERON (Linnæus). A genus of annual, biennial, and perennial herbs, mostly found in Europe. Linnæan class and order *Syngenesia superflua*, and natural order *Compositæ*. Generic character: anthodium imbricated; receptacle naked; florets of the ray ligulate, and very narrow. Increased by seeds or dividing the roots, grows anywhere in flower borders.

ERIGONUM (Michaux). A genus of North American herbaceous perennials, belonging to the natural order *Polygonæ*. Generic character: flowers enclosed in a bell-shaped involucre; calyx bell-shaped, six-cleft, segments obtuse, interior ones somewhat smaller than the exterior; filaments like hairs, longer than the calyx; anthers ovate; style scarcely visible; stigma filiform; achenium three-sided and winged. These plants when cultivated thrive best in pots.

ERINUS (Linnæus). Beautiful little alpine plants, belonging to *Didynamia angiospermia*, and to the natural order *Scrophularinæ*. Generic character: flowers somewhat spiked and bracteate; calyx regularly five-cleft; corolla inclining to salver-shaped, tube cylindrical, limb spreading, five-parted, segments inversely heart-shaped, sometimes emarginate; stamens short; style filiform, with headed stigmas; capsule oblong, two-celled, two-valved, and many seeded. The *E. alpinus* grows readily on old walls, and increases itself readily by seeds. It is a favourite plant for rock-work. There are two or three greenhouse species.

ERIOBOTRYA (Lindley). A genus of Chinese fruit trees, belonging to the natural order *Rosaceæ*. Generic character: calyx woolly, obtusely five-toothed; petals bearded; stamens equally joined to the calyx; styles five, filiform, and hairy; fruit from three to five celled, cells many seeded. The *E. Japonica* was introduced into this country about 1787, under the name of *Mespilus Japonica*, so called by Thunberg. It is said to be indigenous to Japan, but it is very common in China, and is the *Loquat* of Chinese fruiterers. It is a half hardy tree, and withstands frost with a slight covering.

ERIOCEPHALUS (Linnæus). A genus of evergreen shrubs, introduced from the Cape of Good Hope. They belong to the natural order *Compositæ*. Greenhouse plants of easy culture, and propagated by cuttings.

ERIODENDRON (Decandolle). Tropical timber trees, formerly associated with the genus *Bombax*. The flowers are monadelphous, and the trees are placed in the natural order *Bombacæ*. Almost all the genera of this order are known by the capsules being lined with a kind of silky or cotton-like wool, which is put to various uses, but it has not tenacity enough for the fabrication of cloth. In our stoves these trees have necessarily a pigmy habit, and are propagated by cuttings.

ERIOGASTER (Germar). A genus of lepidopterous insects belonging to the section *Pomeridiana* of Stephens, family *Bombycidæ*, and to the division with entire wings, and the palpi not advanced in front. The body in this genus is stout, and densely clothed with woolly hairs; the antennæ are slender, and attenuated at the extremity; the wings are somewhat transparent. The abdomen in the females is furnished with a mass of down. The type of the genus is the *Phalæna bombyx lanestris* (Linn.), a species known to collectors by the name of the small egger moth (so named from the resemblance of the cocoon to an egg), of rather common occurrence; the wings are of a dark reddish tinge, with an irregular toothed streak beyond the middle of the wing, and with a large basal and smaller central spot of a white colour. It varies in expanse from one inch and one-sixth to one inch and five-sixths. Like the genera *Cnethocampa* and *Clisiocampa* (which see), to which it is nearly related; this moth is gregarious in the caterpillar state, living in colonies under a common tent, from whence the inhabitants make nocturnal excursions in search of food, returning before morning by means of silken foot-roads parallel to the branches. The caterpillar is black and hairy, with two red hairy spots and three white streaks on each segment. It is found at the end of June feeding upon the sloe, birch, willow, whitethorn, and other trees. The moth appears at the end of February.

We have already, in our article **CHRYSLIS**, given an account of a curious circumstance which has been observed relative to the occasional duration of this insect for several years in the pupa state.

The cocoon is hard and of an egg-like appearance, somewhat resembling a pheasant's egg. Very little silk is employed in its composition, moreover it is spun with various little pin-holes, as if bored from without, the use of which has not been ascertained. It has, indeed, been suggested, that these apertures might be left as air-holes for the included chrysalis, "as the closer texture of the cocoon might, without this provision, prove fatal to the animal." Ins. Architect. p. 328.—This supposition can scarcely, however, be maintained, inasmuch as we find numerous cocoons of an equally firm texture, which are not furnished with such apertures. There is also another peculiarity which has been observed in this insect, and which is thus noticed by Mr. Haworth, in his *Lepidoptera Britannica*: "When an aurelian possesses a brood of this moth, he readily learns, on the arrival of the month of February, which of his pupæ will become winged that year. This always happens to by far the greater number, and its approach is denoted by the swelling of the larger belts of the

pupæ. Those which are intended to rest until another season do not swell until that season approaches. This swelling cannot be produced by heat, because all the pupæ, those which do not as well as those which do swell, are kept in an equal temperature, and experience the very same treatment. Perhaps," he adds, "they are endowed above by some differing principles which require the differing periods of one, two, and three seasons to repair and bring them to complete maturity, and render them capable of accomplishing the full intentions of their beneficent Creator." Without offering any opinion upon the cause of the prolongation of the chrysalis state, we may satisfactorily account for the swelling of the chrysalides, without attributing it to the acquisition of fresh matter, the swelling of the substance already there, or to the action of heat, by considering, that immediately before assuming the perfect state an increased quantity of air is imbibed by the insect, for the purpose of distending the exceedingly numerous ramifications of the newly developed respiratory organs. "This insect," further observes Mr. Haworth, "is probably of great service to many of our soft-billed birds, at a season when little and insufficient quantities of food are to be procured, especially in severe and rigorous winters, in which the ground remains a long time covered with snow, when this poor moth and some other species of lepidoptera (as soon as escaped from the pupa) stick torpid upon the trunks of trees, where these birds readily find and devour them*, and thus escape from hunger at a time when worms or other terrestrial food are either difficult or impossible for them to procure; these birds, thus saved, are of incalculable service the following spring, in restraining within due limits the insect despoilers of the vegetable kingdom; during which they never fail to cheer us with their charming songs, and lessen the destructive numbers of caterpillars in our orchards and gardens, until in their turn they become the prey, the necessary prey, of some insidious weasel, or birds more powerful and rapacious than themselves; I repeat necessary prey, because they themselves would become too numerous if never destroyed, to the total extirpation of various insects, whose existence in the scale of things is as essential as their own to keep within appropriate bounds certain vegetables which otherwise would multiply to the total exclusion of other weaker and smaller, but equally necessary species; and so on, *ad infinitum*, until, at length, the head, and prince, and king, of all created beings, man himself, would feel the chasm, and experience inevitable woe."

ERIO LÆNA (Decandolle). An ornamental evergreen shrub, native of the East Indies, belonging to *Byttneriaceæ*. It is readily propagated by cuttings struck in peat.

ERIO PHORUM (Linnæus) is a genus of grass-like plants, belonging to the order *Cyperaceæ*, and is the cotton grass common on moors and bogs in many parts of Britain.

ERIO SPERMUM (Jacquin). A genus of bulbous rooted plants indigenous in Southern Africa. The flowers are hexandrious, and belong to the natural order *Asphodeleæ*. Generic character: corolla six-petaled, spreading; stamens inserted into the base

of the petals; filaments flatted and connivent; anthers double arrow-shaped; style triangular; stigma three lobed; capsule three-sided, three-celled, cells with several seeds. These bulbs are grown in loamy turf, moor earth, and sand mixed, and are increased by off-sets.

ERIOSTEMON (Smith). A genus of ornamental evergreen shrubs introduced from New Holland. The flowers are decandrious, and the plants are associated with the natural order *Rosaceæ*. They have some resemblance to *Diosma* or *Adenandra*, and are equally easy of culture in the greenhouse.

ERISTALIS (Meigen), a genus of dipterous insects, belonging to the section *Athericera*, and family *Syrphidæ*, having the thread of the antennæ pilose, and the external cell at the tip of the wing (situated near the angle at the extremity), with a deeply rounded notch at its outer side. The body is thick, the eyes pilose, the hind legs simple, and the third joint of the antennæ large and patelliform. The early states of these insects have been long known; they are described by Swammerdam and Reaumur. The larvæ are in the number of those which reside in the mud of stagnant water, and which have been termed rat-tailed larvæ, from the extraordinary elongation of the terminal segment of the abdomen, which is furnished at its extremity with an organ of respiration, which is easily brought into contact with the air at the surface, and at the same time permitting the larvæ, by the various degrees of extension of which it is capable, to retain its situation in various depths. Before passing to the pupa state the insect leaves the water, buries itself in the soft margin of the sides, the respiratory tube ceases its functions, the body contracts, the skin hardens, and becomes at length the covering of an inclosed pupa, in which the organs of respiration appear in the form of four small horns, placed at the front part of the body. The perfect insects delight in flowers, of which they suck the nectar, in bruised fruit, and in the sap which exudes from wounded trees of which they are not less fond. The females often deposit their eggs without ceasing their flight for this purpose; they suddenly drop themselves to the surface of the water, leaving an egg there, and as suddenly rise again. In this respect they agree with the dragon-flies. When settled upon leaves or other surfaces, the abdomen is alternately elevated and depressed from time to time. Their flight is very strong, and their movements, when on the wing, often very sudden: often they may be observed suspended as it were in the air, balancing themselves on their wings, which are kept in so rapid a motion as to be scarcely perceptible, darting off at the least approach of danger. In most of the species there are many generations in the course of the year. They are to be found in the winged state from the commencement of spring until the arrival of winter. There are about twenty British species of this genus, including the *Musca intricaria nemorum* and *Arbustorum* of Linnæus. The *Musca tenax* of Linnæus, and some other species, form a distinct section in the genus, having the bristle of the antennæ naked.

ERITHALIS (Linnæus). A genus of two species of trees, one is a fruit tree in Jamaica, the other deciduous ornamental of India. They are pentandrious, and belong to the order *Rubiaceæ*.

ERODIUM (Heretier). A genus of annual and perennial herbs, formerly classed with the geraniums. Linnæan class and order *Monadelphica Pentandria*, and

* All insects, except lepidoptera in the winged state, conceal themselves during the time of severe frosts in places inaccessible to birds.

natural order *Geraniaceæ*. This division of the order have mostly regular flowers, and the seeds when united resemble a heron's beak; hence the generic name. They are mostly natives of Europe; three of them are British.

ERODIUS (Latreille), a genus of coleopterous insects, belonging to the section *Heteromera*, subsection *Melasoma*, and family *Pimeliidæ*, having the body short, ovoid, gibbose above, with the thorax short and as broad behind as the base of the elytra, terminated posteriorly on each side by an acute angle; the prosternum is dilated behind into a plate resting upon the mesosternum. The genus comprises three subgenera, *Erodius*, *Zophosis*, and *Nyctelia*. In the first of these the two terminal joints of the antennæ are united so as to form a small mass, and the anterior tibiæ are furnished on the outer edge with a central and terminal spine. These insects, of which the species are very numerous, inhabit the sandy districts of the south of Europe, and the southern parts of Asia, and the north of Africa. The type is the *Erod-gibbus* of Fabricius: it inhabits Egypt.

EROTYLUS (Fabricius), an extensive genus of coleopterous insects, found only in South America, arranged by Latreille in the section *Tetramera*, but which possess so many characters, both as regards their habits and structure, in common with the *Engidæ*, that it appears much more natural to consider the structure of the tarsi as entitled only to a secondary importance. The three basal joints of the tarsi are dilated, cushioned beneath; the penultimate joint being bilobed. The antennæ are terminated by a dilated club composed of several joints, the lower jaws are armed with a corneous tooth, and the palpi terminated by a large transverse semilunar joint.—The species are adorned with numerous colours, in which yellow and red, with black spots and marks, are most prominent. From analogy with some allied British genera, we may consider these insects, which are of a moderate size, as inhabitants of fungi, boleti, &c. M. Duponchet has published a valuable monograph of the genus, all the species of which have been figured therein.

ERPETION (Sweet). A genus of plants separated from the genus *Viola* by the late Mr. Sweet. Class and order *Pentandria Monogynia*, and natural order *Violariæ*. Its species grow well in a warm border, and produce abundance of flowers. In sharp frost they require covering with a mat.

ERVUM (Linnæus) is the generic name of the family of tares, so profusely scattered over Europe. They are all climbing annuals, some of them troublesome weeds among corn. Two of them, the *E. lens* and *E. ervilia*, are cultivated in the south of Europe and north of Africa as human food, and have so been from very remote antiquity. Lentils when boiled readily dissolve into a pulpy mass of a chocolate colour; and we learn that "it was for a mess of this 'red pottage' which Esau sold his birthright. In Egypt and Syria they are parched over the fire in pans, and commonly sold in shops, being considered by the natives the best food to be taken on long journeys. The use of lentils is very common on the continent, especially by the Roman Catholics during Lent. Lentils are also imported into London from Hamburgh, for the use of cooks, who prize them as an ingredient in soups and sauces."—*Bur. Bot.*

Tares and vetches (*Vicia*) afford abundant green food for horses, sheep, and hogs; sometimes they are

made into hay, or reserved for seed, or for feeding pigeons. The winter vetch (*Vicia sativa*) is indispensable to the farmer; when sown along with a little rye in September, they stand the winter, and together are the first green food fit for use in the beginning of May; and then most acceptable as well as serviceable to horses which have been long kept on dry fodder.

ERYCINA (Lamarck). Only one species of this shell is described by Lamarck, and the equivocal character of these shells renders it very difficult to judge of their hinge. The shell is not quite so high as it is long; it is subtrigonal, regularly equivalve, inequilateral, slightly, or not at all gaping; the apices well marked, and inclining rather forward; the hinge sublunar; two unequal cardinal teeth, converging to the summit, and leaving a cavity between them; two lateral slightly distant teeth, lamellar and penetrating; the ligament interior, placed in the cavity; the valves exhibiting two rounded muscular impressions. The only recent species described inhabits the sands of New Holland, but several fossil are enumerated by De France, and others are figured by Deshayes in his work on the Fossil Shells found in the neighbourhood of Paris. This genus belongs to the eighth family *Conchacea*, first section, third order, *Lamellibranchiata*, third class *Acephalophora*.

ERYNGIUM (Linnæus). A genus of perennial herbs found in every quarter of the world. Linnæan class and order *Pentandria Digynia*, and natural order *Umbelliferæ*. Generic character: flowers in a head; receptacle chaffy; involucre rather spinous; petals inflexed; fruit chaffy or scaly, crowned with the calyx. Several individuals of this genus are admitted into the flower garden. Their coloured bractæ being their most striking feature. They affect light soil, and are increased by seeds, which ripen readily.

ERYSIMUM (Linnæus). This genus is called in Britain hedge-mustard, from the acrid qualities with which it abounds. The species are mostly European, having tetradynamous flowers, consequently belonging to the natural order *Cruciferæ*. It is propagated by seeds or cuttings.

ERYTHRÆA (Richard). A genus of annual, biennial, and perennial herbs, chiefly natives of Europe. They are ranked in the fifth class of sexual botany, and belong to the order *Gentianeæ* of the natural system. Generic character: calyx in five parts and five sided; corolla funnel-shaped, limb five-cleft; stamens joined to the tube of the corolla; anthers shed spirally; style short; stigmas two, roundish; capsule of two valves, bent inwards, and having a placenta. The British species called centaury, are met with on moors or dry pastures, and are considered most elegant native plants. When introduced into the flower garden, where they well deserve to be, the seed should be sown in the autumn to ensure their rising in the following spring.

ERYTHRINA (Linnæus). A splendid genus of exotic trees, shrubs, and herbs, remarkable for their high coloured flowers, hence called coral trees. They belong to *Leguminosæ*. Generic character: calyx tubularly bell-shaped, truncated, sometimes with five or two teeth, or two lipped, often spathaceous; vexillum very long; keel of two petals; pod elongated and twisted. Some of the species require the heat of a stove; others stand well in the greenhouse; but the *E. cristagalli* and *E. laurifolia* will live in the open air if protected from the frost of winter; for though the stems die down, they shoot again from the

root, and flower beautifully in the summer. They may be propagated by cuttings. The seeds of *E. corallodendrum* are called Caffrarian peas by Barrow, probably from their being eaten as such by these people. The seeds of *E. Abyssinica* are said by Bruce to be called *karat* in Abyssinia, and there used as weights for gold, whence it is presumed we have our word carat.

ESOX—The pike. A genus of soft-finned fishes, with abdominal fins, in which the edge of the upper jaw is formed by the intermaxillary bones, or where it is not completely so formed, the maxillary bone is without teeth and concealed in the thickness of the lips; generally speaking, the fishes which compose this genus, or rather family, are voracious; but the three divisions of which it is made up are very unlike each other in most of their characters. These divisions are: *Esox*, the pike, properly so called; *Belone*, the gar-fish, and *Exocetus*, the flying fish, which last we shall notice under their English names, only remarking further here, that the pikes are inhabitants of the fresh waters; the other two divisions inhabit the salt; and the flying fishes, as their name imports, can make their way through the air for a short distance.

Pikes, properly so called, have small intermaxillary bones furnished with little pointed teeth in the middle of the upper jaw; the vomer, the palatal bones, the tongue, the pharynx, and even the rays of the gills, are set with teeth; and in the sides of the lower jaw there are large ragged teeth, which, in a fish of large size, are scarcely less than the canines of a small dog. No fresh water fish bites so powerfully as the pike, and hence it is looked upon as one which is peculiarly destructive to other fishes, though its own flesh is in considerable esteem for the table. The flesh is white and firm, but rather dry: there are three species, two of which have been found only or chiefly in the fresh waters of North America. One of these, *E. reticularis*, is marked all over with a net-work of brownish lines; and the other, *E. estor*, is sprinkled over with round blackish dots. The manners of these two species are but little known.

It is usually said that pike were unknown in the English rivers previous to the time of Henry VIII., and that when first introduced they were so rare, that a single pike sold for double the price of a house lamb. But there is little probability in this account, inasmuch as the pike is very generally distributed, not only through the cold and remote waters of the northern parts of the British islands, which nobody of course ever took the trouble of stocking with fish of any sort, but they are also distributed through the very coldest parts of Europe. Pike have been mentioned, as taken in Lapland, as much as eight feet in length; and in one of the slow running rivers of the Scotch highlands, we believe the Glass, we have heard of a six feet pike being taken; in the richer part of the country, they are not so large in size, but whether this be owing to less favourable pasture, or to more habitual fishing, has not been determined.

The general aspect of the pike is repulsive. It is a ragged, savage, and ugly looking fish, and a large portion of the middle of its body being nearly of an equal thickness, gives it a lumpy appearance. The head is very flat, the eyes small, and the irides golden yellow; the upper jaw is broad but shorter than the lower one, and the lower one turns upward at the point, where it is marked by minute punctures. The

teeth, as already mentioned, are very numerous, and are exceedingly sharp. The intermaxillary bones also allow a vast opening to the mouth, so that the pike can seize and swallow large prey. The body is considerably elongated, the back broad, and almost square when the fish is in good condition: at this time also, the colours on the back and sides are very fine, consisting of green mottled with bright yellow, and the gills are of a very bright red, indicating a vigorous degree of circulation. When the fish is out of season, these colours fade, the green turns to grey, and the gills are dull and darkish. The pectoral fins are situated immediately behind the gill openings, the ventral fins are about the middle of the body, and the dorsal and anal are far back, near the tail, which is very stout, with a broad and much forked fin. The whole shape of the fish evinces that the posterior part of the body is the grand impelling portion; and by this means the pike is enabled to rush straight upon its prey.

Those who treat of the manners of fishes record many anecdotes of the uncommon voracity of the pike. Dr. Plott says, "At lord Gower's canal, at Trentham, a pike seized the head of swan, while feeding under water, and gorged so much of it as killed them both; the servants observing the swan to remain motionless, went in the boat, and found both swan and pike dead." Gesner mentions a pike which seized the lips of a mule while drinking in the Rhone, and kept its hold so firmly that the mule carried it ashore. In the year 1798, as two gentlemen were angling in a pond, near Warnham, in Sussex, a pike, of only about seven pounds weight, seized a dog that was lapping the water, and was fairly landed, holding on by the dog; so also in the Blackwater, near Youghall, a yearling calf was seized by a pike, and succeeded in landing him; and there could be no greater proof of his voracity than this attempt to swallow a calf, when his stomach, upon being opened, was found to contain a large perch and a water rat, both entire.

The pike is indeed exceedingly voracious, and seems to be almost destitute of fear, for it has been known to contest for prey with the otter, which is an animal of very powerful bite. Pike, when sufficiently supplied with food, grow rapidly; they live long, and scarcely any foulness of the water will injure them; they often attain a very large size. In some of the Irish rivers, especially the Shannon, and the large lakes through which it passes, pike seventy pounds in weight, have sometimes been caught; and there are accounts of others of very large dimensions taken by trolling. One of the largest caught in this way was taken by colonel Thornton, in Scotland, in the year 1784. This fish was four feet nine inches long and eleven inches and a half deep in the body, and weighed within two ounces of fifty pounds. The colonel had him upon the line for an hour and a quarter before his strength was exhausted, and the tackle would not have held him if the colonel had not been in a boat, and thereby enabled to humour him by rowing.

The pike are fond of dull, shady, and unfrequented waters; but prefer a hard bottom to one covered with mud. In summer they are found among the aquatic plants near the shore of the pools; but in winter they retire into the depths, and hide themselves, if possible, under some projecting stone or irregularity at the bottom. Their spawning time is in March or April; a little sooner or later, according to the place and the season. For this purpose they

quit the large ponds and pools, and resort to the creeks and ditches, depositing their ova among the roots of the aquatic plants; ducks and other water birds are particularly fond of the spawn of the pike, and not only consume great quantities of it, but carry it off, adhering to their feathers, without being injured or having its vitality destroyed. By this means pikes often make their appearance in ponds where there were none before; and this fact, which was well established before any inquiry was made into its cause, was once the source of many conjectures.

Pennant mentions a curious method of taking pike in the fens of Lincolnshire. The fishermen use a basket open at the top and bottom; this they plunge down behind the stern of their punts or fenboats, and by poking with a stick ascertain whether there is a fish in it or not; if there is one, they immediately raise the basket, and throwing the fish into the punt, lower the basket to catch another.

These fish may be also taken with a noose and rod when they are basking in the shallow water, which they do on warm days, with the back at or even partially above the surface. They may also be shot, only the gun must be levelled lower than the fish, because of the refraction at the surface of the water, and also of the shot glancing there; but care must be taken not to insert the muzzle of the gun in the water, as the consequence would be the bursting of the barrel, to the great danger of the sportsman. There are many modes of capturing these fish; and their strength and voracity which render them too destructive in the fish pond, are recommendations in the eyes of the sportsman.

ETHERIA (Lamarck). This shell had probably escaped the notice of former conchologists, from its inhabiting the sea at a great depth, and from its being there attached by the lower valve to rocks, or other fixed objects. Lamarck, therefore, has the honour of having first given a description of it. In consequence of the irregularity of the shape, arising from the faculty the animal possesses of affixing its dwelling to the substance on which it was born, the general appearance of the shell resembles that of an oyster. It, however, is considered by Lamarck more nearly allied to the genus *Chama*, possessing, like the species of that genus, two separate lateral muscular impressions (notwithstanding which, subsequent authors have felt disposed to ally it to the *Margaritaceæ*), its having no tooth at the hinge, and the substance of the shell having a pearly appearance, and being lamellar, as in the oyster, clearly separates it from the genus *Chama*. These shells sometimes attain a considerable size, and are of an extremely variable form, as that depends, as before stated, upon the substance to which it becomes fixed at its birth. The interior of the valves is generally covered with very singular hollow globular irregularly-formed concretions, like small bladders, beneath the pearly coating. These may be only accidental, but it is so common that it appears characteristic. It has also a sub-cylindrical callosity attached to the base of the shell, which does not exist in a second species of this genus, also described by Lamarck. The general character of this shell may be described as irregular, inequivalve, adhering to the lower valve; apices short, and appearing as it were forced into the base of the valves; hinge without teeth, waved, subsinuous, unequal; two lateral and oblong muscular impressions; ligament external, winding, and partly

penetrating the shell. This genus is sub-divided into two species, those presenting an oblong callosity on the base of the valve and those which have none. In De Blainville's System of Malacology this genus belongs to the seventh family *Camacea*, third order *Lamellibranchiata*, third class *Acephalophora*.

EUCALYPTUS (Heretier). An extensive New Holland genus, many of them useful timber trees. They belong to *Icosandria*, and to the natural order *Myrtaceæ*. Generic character: calyx cut round in the middle, upper part open, and seated like a cup; stamens numerous, inserted in a ring within the cup; filaments like hair; anthers roundish; style simple; capsule four-celled, and many seeded. The first of these plants appeared in European collections about 1774, and many have been received since. They are greenhouse and conservatory plants, having fine foliage, and flower occasionally. They are propagated by cuttings, but not readily.

EUCERA (Latreille), a genus of hymenopterous insects, belonging to the section *Aculeata*, family *Apidæ*, and subfamily *Scopulipedes*. The wings are furnished with two complete submarginal cells, the antennæ of the males are nearly as long as the body, and the two lateral divisions of the lower lip are filiform, and as long as the labial palpi. The antennæ of the males likewise exhibit another peculiarity; the last ten joints appearing, when placed under a powerful magnifier, to be composed of innumerable hexagons, similar to those of which the eyes of insects consist. These insects fly about sunny banks, the female making her cells at the bottom of cylindrical burrows formed in such situations. These cells are placed two or three inches below the surface of the ground, they are very smooth within, and of an oval form; in each of them the female places an egg with a sufficient supply of pollen paste for the future larva, which resembles that of the common bee, and which undergoes all its transformations in the cell in which it is born. The entrance of each cell is closed by a covering of earth. It is chiefly from labiate plants that the females collect the honey which they employ. The common species found in this country, and which appears early in spring, especially frequents *Ajuga reptans*, and *Glechoma hederacea*. There are but few species of this genus, of which the type is the *Apis longicornis* of Linnæus. This insect is about half an inch long; the thorax and basal joints of the abdomen are clothed with reddish hairs; the remainder of the abdomen blackish, and the nose yellow.

EUCLEA (Linnæus). A genus of two evergreen shrubs, natives of the Cape of Good Hope, belonging to the natural order *Euphorbiaceæ*. They thrive well under ordinary greenhouse treatment.

EUCOMIS (Heretier). A family of bulbous plants, introduced from the Cape. They belong to the sixth class, and first order of Linnæus, and to the natural order *Asphodeleæ*. Generic character: corolla wheel-shaped, regular, six-parted; filaments dilated at the base, partly united, anthers oval; style awl-shaped; stigma simple, capsule three-celled, many-seeded. These plants flower annually, and are more remarkable for their mode of flowering than for either the size or colour of the flowers.

EUGENIA (Linnæus). A fine genus of fruit and ornamental evergreen trees, natives of the warmer parts of the world. Linnæan class and order *Icosandria Monogynia*, and natural order *Rubiaceæ*. Generic character: calyx persisting, tube oblong,

limb in four parts; petals four, inserted into the throat of the calyx; stamens springing from a ring on the calyx: filaments awl-shaped, erect; anthers roundish; style simple, filiform; stigma obtuse; germen two-celled; berry one-celled. Several species of the *Eugenia* yield fine fragrant fruit, and are plentiful in the market of Malacca and other towns in the eastern islands of India.

EUGLOSSA (Latreille). A genus of beautiful bees inhabiting South America, having the parts of the mouth elongated into a proboscis, as long or longer than the body, the labial palpi are terminated in a point composed of the two last joints. Their economy is not known. Some of them are, however, supposed to be parasitic upon other bees.

EULOPHIA (R. Brown). A genus belonging to the *Orchideæ*, chiefly natives of Africa. There are eight species in the books, and have been all introduced into our collections within these last ten or twelve years. Two fine species from Sierra Leone require to be kept in the stove; the others do well in the greenhouse.

EULOPHUS (Geoffroy). A genus of minute but highly beautiful hymenopterous insects, belonging to the section *Terebrantia*, family *Pupivora*, Latreille, and family *Chalcidæ*, distinguished by having the tarsi composed of only four joints, and the antennæ of not more than eight or nine. In the males these organs are beautifully branched, the branches being long, and arising from the upper side. The *Ichneumon pectinicornis*, Linnæus, is the type. It is of a black colour and very minute. Geoffroy observed the economy of one of the species, which is parasitic in the body of the caterpillar of some nocturnal moth (*Noctua*), out of which, when arrived at the full size, numerous larvæ of the *Eulophus* burst forth, arranging themselves upon the leaf in a circle round the insect which they had thus destroyed. Here they assumed the pupa state, and shortly afterwards appeared in the winged form, being of a fine green colour, with the antennæ straw-coloured at the base. Several other species have been observed, whose economy differs somewhat from that of the preceding.

EUMENES (Fabricius). A genus of solitary wasps (*Vespidæ*), remarkable for the very narrow form of the basal segment of the abdomen, which is long and often pear-shaped, the lower lip is divided at its extremity into three lobes, glandular at the tips, the central one being the largest, heart-shaped, and notched at the extremity. The females, unlike those of the common gregarious wasp, separately construct their nests upon the twigs of plants, especially upon heaths with a very fine kind of earth. The nest is spherical, and, according to Geoffroy, filled with honey. There are numerous exotic species, but one only has hitherto been found in this country, namely, the *Eumenes atricornis*, which is met with in Hampshire on heathy situations.

EUMOLPUS (Kugellan). A genus of coleopterous insects, belonging to the section *Tetramera*, and family *Chrysomelidæ*, differing from *Cryptocephalus*, to which they are very nearly allied by having the terminal joints at the antennæ dilated; the body is very convex, and the maxillary palpi thickened at the tips. The majority of these insects inhabit tropical countries; they are for the most part exceedingly brilliant in their colours. We have already, in our article upon the *Chrysomelidæ*, given an account of the ravages committed by a small species of this

genus upon the vines in the wine countries of Europe. Vide ante, page 41.

EUOMPHALE. A fossil genus of shells established by Sowerby, and forming one species of the present arrangement of the genus *Solarium*.

EUONYMUS (Tournefort). Is the common spindle-tree of our hedges. There are sixteen exotic species from different parts of the world, already described; some of the latest from Nepal.

EUPATORIUM (Linnæus). An extensive genus of herbs, shrubs, and under-shrubs, mostly natives of America. This genus gives a title to a sub-order in the extensive natural order *Compositæ*.

EUPHORIA (Commeline). A genus of Chinese and East Indian cultivated fruit trees; one of which is called by the Chinese *Litchie*, and another *Longan*; both common in the markets of Canton. Class and order *Octandria Monogynia*, and natural order *Sapindaceæ*. These fruits are sweet with a sub-acid flavour, and when the outer shell is dried, the pulp surrounding the seed shrinks from the shell and remains good for several months. In the dried state they are brought to this and other countries of Europe.

EUPHRASIA (Linnæus). *Euphrasia officinalis* is the eyebright of British botany; a common annual frequent on dry pastures. Class and order *Didymia Angiosperma*, and natural order *Scrophularinæ*.

EUPLECTUS (Kirby). A genus of coleopterous insects, belonging to the minute family *Pselaphidæ* (see *BRYAXIS*), having the body considerably elongated and depressed, the antennæ with the two basal joints thickened, and the maxillary palpi conical at the tips. The species are found in deep situations, on moss, &c., or flying in clear sunshine. There are about a dozen species, including the type *Pselaphus nanus* of Riechenbach.

EURYALE (Salisbury). A curious aquatic plant, a native of India, very much resembling the water-lily in the shape of the leaves, their manner of floating on the surface of the water, and in the mode of flowering; but the leaves are remarkably rough with tubercles and spines, and the flowers are by no means so conspicuous, or so beautiful. Class and order, *Polyandria Monogynia*, and natural order *Nymphæaceæ*. When cultivated in this country, the seeds are sown in large tubs of water, and placed in a hotbed.

EURYCLES (Salisbury), a bulbous genus found at Amboyna, and other places in the East Indies. It is a hexandrious plant, and belongs to the natural order *Amaryllidæ*. It was described as a *Pancratium* by Linnæus and Ker, and a *Crinum* by Roxburgh.

EUTAXIA (R. Brown). A genus of two species of evergreen shrubs, natives of New Holland. The flowers are decandrious, and belong to the natural order *Leguminosæ*. Those plants require pruning or topping when young, to make them bushy, and are easily increased by cuttings.

EUTERPE (Gaertner.) A genus of palms, natives of the African islands, of Madagascar, &c. and South America. They were united to the *Areca* family by Jacquin and others.

EVANIIDÆ. A family of hymenopterous insects belonging to the section *Terebrantia*, and sub-family *Pupivora*, having the antennæ composed of thirteen or fourteen joints, the mandibles toothed, the wings veined, and the abdomen attached to the thorax close to the scutellum. The ovipositor is either not exerted, as in *Evania* and *Pelecinius*, or very long, as in *Fænus*, *Aulacus*, and *Megalyra*.

The typical genus has the antennæ elbowed, the abdomen very minute and compressed, and fixed to the posterior and upper part of the thorax. The species are of small size, and are stated to be parasitic upon the species of cock roaches. The type, *Evania appendigaster*, Linnæus, is attached to the *Blatta Orientalis*, and is therefore not considered by Mr. Stephens as an original inhabitant of this country.

EVENING FLOWER is the *Hesperantha radiata*, of Ker, a family of bulbs allied to *Ixia*, natives of the Cape of Good Hope. They require the same treatment as other Cape bulbs, that is, potted in light soil, and kept in a cold frame to flower.

EVERGREEN THORN is the *Crataegus pyracantha* of Persoon. A hardy ornamental shrub, very frequently planted on the walls of town houses, where its scarlet fruit are particularly showy in winter. The fruit are seldom seen in the country, being devoured by birds as soon as they are ripe.

EVERLASTING is a species of *Gnaphalium*, so called from the long duration of the flower after being cut and dried.

EVERLASTING PEA is the *Lathyrus sylvestris* of Linnæus. The broad leaved species is also called everlasting, and is often seen growing against the walls of the courts of town houses.

EVOLVULUS (Linnæus), a genus of climbing exotic annuals, having handsome flowers, for which they are sometimes cultivated in our stoves. They belong to the fifth class of Linnæus, and to the natural order *Convolvulaceæ*.

EXACUM (Linnæus), a genus of exotic annuals belonging to *Tetrandria Monogynia*, and to the natural order *Gentianeæ*.

EXCÆCARIA (Linnæus), a genus of hothouse plants, belonging to the natural order *Euphorbiaceæ*. They are treated like other plants of the order, and increased by cuttings struck in heat.

EXOCARPOS (Labillardiere), a genus of timber shrubby, and climbing evergreen plants, found in New Holland. Linnæan class and order, *Monœcia Pentandria*, and belonging to the natural order *Osycideæ*. These plants do well with ordinary greenhouse management.

EXOSTEMMA (Richard). A genus of ornamental timber trees, natives of the West Indies. Class and order, *Pentandria Monogynia*, natural order *Rubiaceæ*. These plants were formerly arranged with *Cinchona*, but separated therefrom by Richard. They are stove plants, grown on loam and moor-earth, and propagated by cuttings.

FABA (Moench). This is the well-known common garden bean, called by Linnæus *Vicia Faba*, and thereby signifying the plant to be a species of vetch. It is now raised to the rank of a genus, but without congeners. The flowers are diadelphous, and of course the plant is ranged among the *Leguminosæ*.

The common bean is one of our most useful culinary vegetables; and as a field crop, of very great value as horse food. There is a vast number of varieties of this vegetable, as well for garden as for field purposes; nearly a score of each are named in seedsmen's catalogues.

The grand object of the gardener in the culture of beans is to have them ready for the table as early as possible: to have a regular supply throughout the season, and always in abundance. With this view he

should sow the first crops in the months of October, November, and December, either on a warm and sheltered spot, where they are intended to remain, or on seed-beds when they may be conveniently covered in severe weather; whence they are transplanted into drills in the open borders, or quarters of the garden, when the wintery weather is past.

For all these early sowings, the mazagan variety is preferred, not only because it is one of the most delicate in flavour, but also because it is the hardiest of all the garden sorts. To have a regular supply, a pint of seed should be sowed every three weeks from the twentieth of October to March.

In January and February, and throughout the spring months, the larger sorts, beginning with long pods, should be put in at different times to allow the crops to succeed each other seriatim: the sowings to be continued till the end of May, and even longer: for, if the white blossom or mazagan be sowed even so late as July, a favouring season may bring forth a late crop in the autumn.

In sowing these large seeds it should be observed that they require a firm seed-bed. The ground should be good, and specially prepared for them: but if this be done two months before the beans are put in, the seedlings will rise the stronger for it. But if sowed on newly digged or trenched ground, the bottom of the drills should be trodden hard as well as the earth with which they are covered. Even if dibbed into firmly consolidated ground, the plants rise with greater vigour.

Transplanting beans is practised by gardeners for two special reasons: first, as already observed, because the earliest sowings can be safely kept through the winter by being occasionally covered with glass or mats. Being sown thickly together in a frame, or on narrow beds in the open ground, they can, when necessarily, be easily covered with a mat or two, and, when the season permits, removed to their final stations. Another reason is, the check which the plants receive by the removal causes them to flower sooner, and at the same time makes them more abundantly fruitful. A seed-bed, moreover, requires but a small space: and it may happen that the ground intended for the crop, is occupied by other vegetables not yet to be cleared off, and which it may be advantageous or convenient to let remain, till the season for transplanting the beans arrive.

The bean, being a rank growing plant, requires a deep rich loamy or clayey soil, if a great crop be looked for; the stems, being high and heavy, require a firm hold of the ground, to prevent them being laid by the wind or rain; and this is the reason that, when planted on light garden soil, it should be well compacted, to allow the plants a good hold.

Beans are usually sowed or dibbed in drills, the dwarf-growing sorts at two feet, and the larger kinds at two and a half, or three feet intervals between the rows. The spaces from seed to seed varies with their size; two inches is enough for Mazagans, though Windsors require at least five-inch distances between. The fact is, the thinner they are sowed the better they grow, flower, and bear. During growth they should be kept free from weeds, and be earthed up when necessary.

Topping is an old and serviceable practice; if done in good time, that is, as soon as there is a sufficiency of blossom on the stem, it assists to swell the pods and seeds, and often prevents the attack of

aphides, which invariably fix themselves on the tops.

Beans are cultivated on farms possessing a soil suitable for them. As before observed, it is only on naturally rich and heavy land that the culture of beans is profitable. In some districts wheat and beans are alternately raised on the same fields for many years together. The wheat stubble is dunged in the autumn, and then ploughed in; the surface becomes mellowed by the frosts of winter, and early in January is harrowed smooth, and the seed is immediately either drilled in by a machine, or dibbed by hand. The crop is kept clean by the hoe during summer, and cut and carried as early in the autumn as possible, to allow for ploughing, and sowing the seed.

Good crops are sometimes reaped from lighter descriptions of land, but these can only happen in consequence of the season being what is called 'a dripping one;' because, if dry, a light unprofitable return will certainly follow.

The best varieties of the common bean for garden culture are—the mazagan, early longpod, sword longpod, green or nonpareil longpod, Taylor's large Windsor, common ditto, and green ditto. Farmers' varieties are—small horse, the pigeon, the Heligoland, and mazagan. The larger sorts are also grown by farmers for the seedsmen.

FABRICIA (Gærtner). A genus of New Holland evergreen shrubs, belonging to the order *Myrtaceæ*. Generic character: calyx nearly superior, five-cleft; corolla of five clawless petals; stamens inserted on the throat of the calyx; filaments awl-shaped; anthers roundish; style simple; stigma capitate; capsule many-celled; seed small and winged. These plants are suitable for a lofty greenhouse or conservatory, and grow well on loam or moor earth. They are propagated by cuttings.

FALCON (*Falco*). A genus of *Accipitres*, *Raptors*, or birds of prey; and in some respects the most interesting of the whole order, and indeed of all the feathered race. They are inferior in size to the eagles and vultures, and also, feathers included, to some of the owls; but they are, of all birds, the most symmetrical in their forms, the most elegant in the style of their flight, and the most courageous and daring in the capture of their prey. It is indeed impossible to imagine a more beautiful adaptation than that of the falcon to the air and the air to the falcon. Light and graceful in their forms, firm in their plumage, beautifully adjusted in the relative proportions of their different structures, the falcons are perfect models. Not the eagle itself has a keener or more beautiful eye, though the eagle has to look out for prey which is lurking on the ground; and not any birds, even those which are most constantly on the wing, have their organs of flight so finely formed, and so firm in their texture, as the falcons. Nor are their organs of prehension and of preparing their food at all inferior. The beak of the falcon is not a large beak; neither are the claws of as large a size as they are in other birds of prey, which are less dashing, and even less powerful in the style of their preying. Vulgar belief is apt to associate power with those elements only which strike the first and unreflecting observation as being of the very highest order; and hence, a great beak and great claws, and the talons bent till they are semicircles, are the common notions of powerful armature in a bird of prey. But there cannot be a

greater mistake than this, or anything more calculated to give a false impression of that in which real power of action consists. Mere size is in itself a disadvantage; because matter, how much soever there may be of it, contains in itself no principle of action, and never moves unless it is moved by a mechanical or a vital impulse. Hence, in proportion as the beak of a bird is large and heavy, it requires the greater quantity of muscle to put it in action; and we know well, from comparing large and small animals of the same kind, that the large one, though its mass may give it great power for a short effort, is soon exhausted, and that the real power of endurance is in the small. So also in the claws of a bird of prey, curvature, beyond a certain degree, is a means of weakness, if the claw is to be an instrument for giving a death-stroke, and not a mere instrument of prehension. Thus, upon looking at the claws of the harpy eagle of America, and at those of one of the finest and boldest falcons of the northern mountains, one would be very apt to suppose that, from the size and curvature of the former, and also the size of the bird, it would be invincible; but if one of those large and lumbering catchers of fish were to meet in the free air of heaven with the white falcon of Iceland, and if the spirit of the falcon were up, for she seldom engages in mere strife, one stroke of her comparatively small claw would tumble the harpy to the earth. A very remarkable instance of the comparative feebleness of those crooked-clawed fishing birds of prey lately occurred at a collection in London, where a large and powerful osprey had been incautiously put into the same cage with a buzzard; and it had very nearly been made buzzard's food before the keepers could separate them. Some very characteristic species of the falcon will be found figured in the accompanying plate **FALCONS**.

In order, however, fully to appreciate the beauty of that adaptation, of which the falcons furnish so fine an instance, we must consider the medium in which they act, and the mode of their action in that medium. Now, though there are considerable differences of structure and of action among the different species or sub-divisions of falcons; yet they may be said to capture their prey in the free air, or to wound it there and send it down to the earth, more exclusively than any other birds of prey. In general flight the falcons do not perhaps rise so high as some of the eagles; and it is not necessary that they should; for while the eagle mounts up for the purpose of surveying a large horizon of the ground, the falcon scans a far extent of that air in which it floats; and its higher flight and more powerful wing, enable it to occupy a higher place in the sky, and take a wider range than any of the hawks, in which the wings are shorter, broader, and rounder than they are in the falcons, in order to suit a flight which consists of shorter stretches with more risings and descents.

From the rapidity of their flight, and the length of time which they can continue on the wing, falcons may be said to have command of the entire globe; though there are different species adapted to different localities, and it may be said that the more powerful and more splendid ones have their native localities in the cold and temperate latitudes. There are indeed few parts of the world without falcons of some description or other; but those of the warm latitudes are, generally speaking, of smaller size, less powerful wing, and far inferior celebrity to the noble hawks of the north, which was the appellation given to the falcons

in earlier times, when every lord rode out with his peregrine on his arm, and every lady with her merlin. It must be admitted that, in an economical point of view, hawking was by no means a profitable sport; but, in the days when it and similar pursuits occupied so much of the attention of our forefathers, the state of the country was very different to what it is at present. The accommodations of the mass of society were few; and the greater part of those, even of the most elevated and wealthy class, were not, generally speaking, of that delicate, expensive, and perishable character, which we find in modern times. The baronial castle was so massy, as to be good for several generations without any repair; and the same might be said of its homely and substantial furnishings. To strew the floor with rushes cost not more labour than the mere laying down of a carpet, to say nothing of the number of hands and length of time which must be employed and occupied in the manufacture of it, and of all the machinery necessary for the said manufacture. It was much the same in every thing else: the substantial implements and utensils of the people were all of a permanent and baronial character; and that they had been used by a long line of ancestors, gave them more merit in the eyes of the life occupants, than the first rate fashion of modern furnishings. At the same time there were few books, and equally few who either could read, or cared anything about the matter. We have seen charters granted by a Bishop, and signed in the Bishop's name by a lady, with the expressed declaration in the docket that the reason of this substitution was that the bishop could not write. When this was the case with the diocesan of an extensive, and far from a poor, province, it could not be supposed that the common file of even the lords of the soil could be *very* literary. Thus one can readily suppose that their time hung heavily upon their hands; and that, in order to escape from the ennui of their own ignorant society, they were glad to claim kindred with the beasts of the field and the fowls of the air in every possible way. It is true that their attention to these did not much promote the natural history of the creatures, in any one useful or rational sense of the term. But we must not blame them for this: there was little or no science of any kind in those days, and even down to our own times, the hunters and the hawkers have done very little towards increasing our rational knowledge of the animal kingdom. We believe we do them little injustice (and we have no wish to do them any), when we say, that all that they have done, unless where the love of natural history predominated over the love of mere sport, would not make above a page or two in the progressive annals of the science; while, in the more important and higher department of tracing the connection between any one animal and the general system of nature, we presume they could not with justice be found guilty of a single paragraph. Thus the use of falcons in sporting belongs to a former people, and though there are still a few who keep hawks, they may be regarded as being kept more from the vanity of ancestry than from any direct pleasure which the keepers have in the possession or use of them. No doubt there are a few, on the confines of the wilder districts, where there is still little to interest except the wild productions of those districts, who do keep falcons and fly them; but the very fact of those persons being found chiefly in the wild places, is of itself sufficient to show that falconry is a sport of a rude

and illiterate age of the world, and quite incongruous with the character of the present times. At the same time we are ready to admit that, among those who require these birds as a means of killing time as well as game, falconry is withal a splendid sport. The perfect training of birds which are, when in a state of nature, the most free and independent tenants of the sky, the grace and rapidity with which they perform their work, and all the circumstances of the sport, when exercised *bonâ fide* against animals truly wild, or left to the uncontrolled exercise of their natural powers and resources, has many charms about it,—not the least of which is that it carries one back to years which are long gone by. Now, however, it has only become an antiquary's tale, and, as such, it forms no portion of natural history. We have indeed falconers, who fly their "gentles" at pigeons and other birds which are let loose from a basket or trap; but the hunting or hawking of that which is previously in possession of the hunters, is a most ludicrous matter—an outrage upon antiquity, and puts one in mind of the covering of four brick walls and a flat roof over with stucco, in order to make a miserable counterfeit of a Gothic chapel, in which the supporters and the supported are made completely to change places. But to return to the falcons—

The general characters of the old genus *falco*, which included all the diurnal birds of prey except the vultures, are these: the head is covered with feathers; beak hooked, and generally curved from its origin; at its base it has a coloured cere, more or less hairy; the under mandible obliquely rounded, and both the mandibles sometimes notched; nostrils lateral, rounded; or ovoid, pierced in the cere and open; the tarsi are covered with either scales or feathers; three toes before and one behind, the outermost one frequently connected by a membrane to the middle toe at its base; pointed and sharp claws, moveable, retractile, and much hooked. This numerous division of the diurnal birds of prey has been conveniently distributed into several sections. As well as the characters which we have just stated, they are distinguished by a projection over the eyebrows, which gives their eyes the appearance of being deeply seated in their orbits, and imparts a very different aspect to their physiognomy from that of the vultures. The first plumage differs very frequently in colour from that of the mature bird, which is not perfect till the third or fourth year, and even later, a circumstance which has betrayed many ornithologists into an erroneous multiplying of the species. In general the female is about one-third larger than the male, and has been providently endowed with superior strength, because it is necessary that she should both feed and protect her voracious offspring; whereas the smaller dimensions of the male are more adapted to the rapidity and loftiness of flight, and is accordingly more esteemed by falconers. Though they are all carnivorous, they seldom, except when pressed by hunger, which they are capable of enduring a long time, feed on carrion. They have a very acute sense of sight, and with surprising force pounce down on their prey with the greatest accuracy and promptitude; manifesting, however, very different degrees of courage in pursuit of their game. They are capable, owing to their great strength, of carrying birds or other animals, nearly as heavy as themselves, to a considerable distance, sometimes as much as forty miles or even more, for the nourishment of their

young. Many of the species eat fish, and others feed principally on the smaller birds, snakes, and reptiles. They never associate in flocks; and, except during the breeding season, even two of them are seldom seen together. Their nests or eyries are generally built in very lofty and inaccessible places; but there are a few that form them on the ground. Many of these remarks apply to the hawks with short and broad wings, as well as to the falcons properly so called; and indeed the habits of the one race run so much into the other on the confines, that it is not easy to draw the line of distinction between them. This is more especially the case in some of the foreign falcons, which are much less noble birds than those of the north; and some, which have many of the external characters, not only feed upon carrion, but occasionally upon crustacea, which is not the case with the more typical ones of Europe.

The peculiar characters of the true falcon are—the beak curved from its base, with a tooth, and sometimes two, on each side of the upper mandible near its point, and corresponding notches in the lower one. The point of the upper one is very sharp and much hooked, and that of the lower is rather sloping and convex, but acting with a powerful grinding motion against the concavity of the hook. The degree of toothing in the mandibles does not bear any relation to the absolute power of the falcons; because the beak in them is an instrument for dressing their prey rather than for killing it; and therefore the smaller species, which prey upon little birds, and have many feathers to pull in order to obtain a small quantity of food, have the mandibles most complete in this respect, while some of the most powerful of the whole have the tooth comparatively blunt. In the wings of the true falcons the second quill is always the longest, though the first is very little inferior to it in length. These two have their shafts and webs remarkably firm; and the others, as far as the tenth, shortened gradually, so as to form a pointed wing.

Those pointed wings are not so good for straight-forward flight in perfectly still air, as wings which are broader; and therefore, when there is no wind, and the falcon is on level flight, it always flies obliquely or curving; the same may be also observed in the swallow tribe, and indeed in all birds which have the wings much pointed. But this form of the wings constitutes, or at least constituted, one of the chief excellencies of the falcons as sporting birds. Such wings are of course not good for mounting the air, unless they have some resistance with which to contend; and therefore falcons “get the sky better” directly against the wind than in any other direction; and, as it is the reverse with birds at which falcons chiefly were flown, this gives the falcon great advantage in capturing those which are of powerful wing and doubling flight.

When a hawk or other bird of prey endeavours to gain the sky by flying with the wind, it is said to turn “down the wind;” and this was reckoned a very great imperfection, because the bird got on so slowly in this way, that the prey had time to escape before it could turn and take advantage of its “rush” from the upper air. The true falcon never turns down the wind in this way; and thus, when it is unable to come up with the prey in simple chase, and turns off to gain a sky power, it always turns to windward, and its ascent, if seen sideways, is much more nearly in a perpendicular direction than one would

expect. Indeed, any one who reflects on the matter will readily understand how the wind and the falcon, by being two forces acting at an angle to each other, must produce a resulting motion of the falcon, in the diagonal direction, and upon the well known principle of the composition of forces, and the resulting force in mechanics, send the bird much more rapidly, and much more directly upwards, than if it had to work its way wholly by the action of the wings. The falcon thus gains her elevation with comparatively little labour, and arrives at the same altitude with much less horizontal distance than if she had a side wind, and especially if she went down the wind, which would then carry her horizontally away from the prey, and render it exceedingly difficult for her to gain such a height, as that she would return upon it with any impetus, or indeed with any chance of seizing it. This is a very beautiful instance of mechanical action, and structural adaptation of the falcon to the wind; and we shall not admire it the less when we come to consider that the more powerful falcons chiefly inhabit those places of the earth and those descriptions of surface where the winds are never long at rest. The falcon is a mountaineer, not exactly a cliff bird like the golden eagle, but a careerer of moor and dell, where the differences of these are considerable, and where, what with one diversity of surface and what with another, there is generally a wind from some point to act as a lever in heaving up the falcon to her height in the sky, and that with the least possible horizontal deviation from that prey upon which she is to rush after she turns. In this part of her action she bears some resemblance to the eagles, though in general she strikes in the air, and not on the earth as the eagle does. After she turns, she remains poised for a few moments, her wings acting the while with great rapidity; and there is little doubt that this action of the wings tends to excite all the energies of the bird to their very utmost, as well as to enable her to take her aim with unerring certainty. The moment that she has by this means gained her excitement and her poise, the rush with which she descends resembles that of the lightning, and, when seen laterally, it absolutely dazzles the eye. In such a case, if the breeze is moderately fresh, and the falcon powerful, the capture of her prey is certain, be it almost what bird it may; for she now descends, in her oblique but arrowy path, by the combined energy of three forces—her own excited action, her gravitation, and the force of the wind. The prey seems to be well aware of this, for, though it may be a lapwing, or a pigeon, or any other bird which is “clever at its feathers,” and which has thrown her out at simple chase till she has abandoned that style of pursuit, it screams and appears powerless and vanquished, even while the falcon is yet so high as to appear no bigger than a lark; and after the scream one can hardly count moments till the prey is struck to the ground. In the whole action of animals of wild nature in the finding of their food, there is perhaps none equal in point of style and beauty of mechanical contrivance, and adaptation to this contrivance, as this rush of the falcon upon the wide moor, where prey and preyer are equally in their element in free nature, and in the full possession and practice of all their resources. We shall perhaps have to revert to it in the course of this article.

Among falcons, properly so called, Cuvier makes a distinction which is probably well founded; and that is, the distinction between falcons and jerfalcon.

The former have the beak more completely toothed than the latter; but the latter are the more powerful birds, not inferior certainly in point of wing, were equally docile when trained for falconry, more hardy from being inhabitants of colder climates, and when genuine perhaps more esteemed. We shall now notice a few of the principal species, and, in the first place, we shall advert to the falcons properly so called, which are numerous, and then to the jerfaleons, which are comparatively few. We may remark, however, in passing, that it is very difficult to be correct with species in the case of falcons, more especially of those which are natives of foreign countries, and of which only a few specimens have been seen. There is hardly a European or even a British species which has not, when in different plumages, been described as more than one species; and very generally the male, which is always about a third less in weight than the female, and differently coloured, has been regarded as an entirely different bird. In some respects the difference is correct; for the female is generally, if not always, a bird of bolder character and a more noble preyer than the male. The falconers were well aware of this; for, while every honour was associated with the name of *the falcon* or female, the *tersel* or male was an inglorious appellation. In their early plumages and before they acquired the grey, which is characteristic of the mature birds, the female was a *red falcon* and the male a *red tersel*, but these latter appellations were chiefly applied to mature birds of the species which we shall first describe.

THE PEREGRINE FALCON (*Falco peregrinus*) is the falcon *par excellence*, because, though perhaps not the most powerful, it was the most generally in use, and also one of the most elegant. The length of the female is about sixteen or seventeen inches, and the extent of the wings an inch or two more than three feet. The bill is bluish black, yellowish at the base; gape and cere yellow. The whole upper parts of the plumage dusky black, with a cinereous dash; the shafts of the feathers black, and the margins slightly edged with ferruginous brown; the forehead pale; the sides of the neck and back mixed with yellowish white; a black patch behind the eye; from the corner of the mouth a broad black streak pointing downwards; chin ferruginous white; the whole of the under parts the same, with a broad streak of dusky black down the shafts, less conspicuous on the throat and vent; under and upper tail coverts barred with dusky and ferruginous white, the former dashed with cinereous; quill feathers dusky black dashed with cinereous; the inner webs with transverse oblong spots of ferruginous white; the under coverts of the wings alternately barred with black and white. Tail dusky black, dashed with cinereous, with eight pale ferruginous bars, least conspicuous on the outer webs of the exterior feathers; one of the bars constitutes the extremity. The bill and talons of this species are remarkably strong, the former being much hooked, and furnished with a tooth-like process on each side of the upper mandible, which enables it to cut and tear its prey with greater ease. The wings are very pointed, the second feather being the longest, the first not much inferior, and the tail short, so that the wings when closed reach very near the end. The legs short, strong, and pale yellow; the toes long, and furnished with a projecting callus beneath at the second joint.

Though most abundant in the hilly parts of the temperate regions of the world, the peregrine falcon,

from the vigour of its flight, is occasionally seen in all parts of the world, at least of the eastern hemisphere; and indeed the range from the middle of Europe to that of Africa is only a morning's flight for it. It is also as long-lived as it is fleet and discursive. One is mentioned as having been met with in Southern Africa, in the year 1793, wearing a gold collar dated 1610, and known at that time to have belonged to James I.; though more than 180 years old, it was still in complete vigour.



Peregrine.

The peregrine falcon inhabits all the temperate and colder parts of Europe, ranging from Iceland to the islands of the Mediterranean, frequenting high and rocky mountains, and building its nest, about the end of February, in precipitous cliffs, with a southern aspect. The eggs are generally three or four in number, white and spotted with brown. It is rarely met with in champaign countries, and never in those of a marshy description. In Germany and France it abounds, is pretty common in Holland and England, but is seldom met with in Switzerland. There is scarcely any part of our coasts, from north to south, where the cliffs rise to three or four hundred feet, in which they are not found scattered in the breeding season, and from which they seldom retire, except as occasional migrants, or when the young are driven to seek for fresh quarters. The insulated rock on which the castle of Dumbarton stands has been particularly quoted for a breed of the peregrine falcon. The growth of the young is so rapid that in three months they are said to equal their parents in size. We may also remark that they are very courageous birds, darting suddenly, perpendicularly, and with great rapidity, on their prey, which principally consists of partridges, pheasants, quails, wood pigeons, &c., and the smaller quadrupeds. They also attack the kite, and compel it to relinquish its victim, but spare its life, as if in contempt of such a dastardly adversary. Various instances are recorded of their fleetness of flight; thus, one that eloped from its master, in the county of Forfar, on the 24th of September, 1772, with four heavy bells at its feet, was killed on the morning of the 26th of the same month at Mostyn, in Flintshire. Another one, belonging to a Duke of Cleves, flew out of Westphalia into Prussia in one

day; and in the county of Norfolk one was known to make a flight at a woodcock, at nearly thirty miles in an hour. A still more remarkable example is that of a falcon which belonged to Henry IV., king of France, and which, having escaped from Fontainebleau, was found twenty-four hours after in Malta, the space thus traversed being not less than 1350 miles, and corresponding to a velocity of fifty miles an hour, supposing the bird to have been on wing the whole time. But, as these hawks never fly by night, such a rate of progress would amount to seventy miles an hour, supposing the day to have been at the longest, or to have lasted eighteen hours. It is probable, however, that he neither had so many hours of light in the twenty-four, nor that he was retaken the moment of his arrival, so that we may fairly conclude much less time was occupied in performing such a distant flight.

The wild gallinidæ form the principal food of the peregrine falcon; and it strikes its prey occasionally with the beak as well as the talons, and on the ground as well as on the wing; but still its principal habit is that of a wing bird, and it often gives long and very vigorous chase. In their lowest descents they prey much upon partridges, though in their upper haunts they feed more upon the different species of grouse. When on partridge hunting they do not beat the air, as that would be the means of making the prey lie close and undiscovered in the herbage. The falcon keeps watch stationed on the top of a hillock, or a low branch of a tree; and when a covey of partridges rises it dashes across them, and endeavours to strike, which it often does with so much force as to kill the bird, and then doubling instantly, as if knowing what it had accomplished, it seizes it before it reaches the ground. When hunting for partridges its habits are peculiar; it does not beat the ground and descend upon them, but endeavours to raise them by flying close to the surface, in which case it makes a peculiar sound. It is by no means unlikely, however, that some of those low flights which have been attributed to the peregrine falcon are really those of the harriers or buzzards.

The gallinaceous birds, from their heavy and lumbering flight, are very easy prey when once on the wing, or when by any means they are once got sight of. They are not, however, the only prey of the peregrine; for it gives chase to ducks, pigeons, snipes, and other birds which have great command of themselves in the air; and it will continue in pursuit of these for a considerable number of miles, including doublings, in which last some of them are more dexterous than the falcon. On these chases the average rate of flight, including doublings, may be estimated at about sixty miles in the hour, or a mile each minute; but the forward rush of the falcon is probably twice as swift as this.

Of all the prey at which the peregrine flies, the heron appears to be the hardest to master. This arises in a great measure from the height at which the heron flies, and which renders it very difficult for the falcon to get the sky of him; and as falcons can do little or nothing to a bird above them, the heron is in perfect safety as long as he can keep uppermost. The heron too can ascend as rapidly on the wind as the falcon can do against it; and thus, as he makes much more distance on his ascent than if he were against the wind, the attempts of the falcon to gain the sky always throw her to a distance. Even when the falcon does get uppermost, her victory over the

heron is not so certain as that of most other birds. The heron has still a means of defence, which is not only good for self protection, but also somewhat perilous for the falcon. The immensely long neck of the heron is, during flight, either extended, if the flight is rapid, or folded back on the shoulders, if the bird is gliding on with easy wing; but the heron can also turn his neck so as to project his bayonet-like bill upward behind the wing, at the same time that he continues his flight. This answers two purposes; in the first place the head or neck of the heron are the parts at which the falcon strikes, because, though wounded in the wing and brought to the ground, the bill of the heron is so formidable, and he uses it with such dexterous rapidity, that he might defeat or even kill the falcon at close fight, though his wing were crippled. Now the doubling of these parts under the wing secures them from this danger, and the only part at which the falcon can strike with effect is the wing. But to strike at that is also dangerous, because from the position of the head the heron can see exactly the direction in which the falcon is coming, and so receive him on the point of his long and strong bill, as a soldier receives an enemy on the point of his bayonet. This difficulty which the falcon has in mastering the heron, made the hawking of that bird a very choice and even a royal sport in the days of hawking; and great pains were taken to preserve herons for this purpose. Indeed at close quarters, and when they are on an equality as to level, the heron is nearly a match for even the golden eagle itself, though in absolute power it is a comparatively feeble bird. There is an account given by Colonel Montagu, which is worth quoting in order to show how determinedly the heron will resist, even when subjected to that mutilation which sportsmen sometimes practice when they have made up their minds as to which of two contending animals shall certainly have the advantage. A female falcon of a year old, in the possession of Colonel Montagu, which had been taken before it could fly, and thus had had no experience in the killing of any thing but a small bird occasionally, was kept a whole day without food. At the expiration of this period, an old male heron was introduced into the apartment of which the falcon had free range; but the point of the heron's bill had been previously sawed off. "As soon as the heron was in motion, the falcon, who was also deprived of the means of flight, took post on a stool which was at one end of the room; and as the heron, regardless of his enemy, traversed the apartment, the falcon motionless kept her eyes fixed on her destined prey, till, after several turns round the room, she judged the heron was sufficiently near to effect her purpose, when she sprang at the head, intending to seize that part with her talons. In this, however, she failed, the stool not having given her sufficient elevation to reach the high erected head of the heron. This failure might probably have cost the falcon her life, had the bill of her antagonist been perfect; for she received a blow on her body that must otherwise have inflicted a severe, if not a mortal, wound from so pointed an instrument urged with such power. Baffled in this attempt, and having received a severe blow, it was conjectured no further attack would be made until the calls of hunger became more urgent. The falcon, however, soon regained her station, and it was not long before we perceived the heron, regardless of his foe, again pass very near, when the falcon, in a second attempt to seize

her prey as before, was equally foiled, and again received a severe check from the bill of the heron. Finding her efforts had failed for want of the advantages nature had assigned her, instinct directed the falcon to a box that stood on the opposite side of the room, which was somewhat higher. Here she again seemed to meditate another attack by watching every motion of the heron, who continued his rounds with a view to make his escape; and it was not long before an opportunity offered for falco to make an assault from her more elevated station. Here she had found an humble substitute for those powers with which nature had so amply furnished her, but of which she had been deprived, and at last succeeded in springing from her perch and seizing the unfortunate heron by the head and upper part of the neck with her talons, which instantly brought him to the ground. Now the unequal contest was soon determined; for in vain did the superior weight and strength of the heron drag and flounder with his enemy across the floor; in vain did he flap his unwieldy pinions to shake off the tyrant of the air; nor could even his gigantic legs force her from the bloody grasp; her work was short and certain; no efforts could compel her now to quit her deadly gripe; the powerful and only dreaded arms of her antagonist were secured, and, thus disarmed, he became a sure and easy prey. Scarcely was the gigantic bird prostrate on the ground, than death ensued; for in this noble race, destined for blood and slaughter, torture makes no part of its nature, but, like what we are told of the generous lion, exulting in death, but disdaining cruelty, in less than half a minute did the falcon tear out the gullet and windpipe of the heron, and regale on the head and neck."

It has often been said that the American bird of prey, popularly known in the United States as the duck hawk, is the same species as the peregrine falcon of Europe; but this seems doubtful, and indeed, with the exception of the osprey, it is questionable whether the same species of any bird of prey is found in the two continents; or if the same in origin, it is so much altered by climate and circumstances, as to form a variety at all events, if not a distinct species. Wilson says that the American bird, during the breeding season, retires to the gloomy recesses and swamps of the cedar forests, in the tall trees of which it constructs its nest, and rears its young secure from molestation. In these wilds, almost impenetrable to the foot of man, its screams are occasionally heard mingling with the hoarse tones of the heron and the hooting of the eagle owl. In this respect, and several others, the American duck hawk seems to differ from our peregrine falcon. The anecdotes related of the dexterity and prowess of this noble bird are innumerable; a writer, in a popular periodical, describes one pursuing a razor-bill, which, instead of assaulting as usual with the death pounce from the beak, he seized by the head with both claws, and made towards the land, his prisoner croaking, screaming, and struggling lustily, but being a heavy bird he so far overbalanced the aggressor that both descended fast towards the sea, when, just as they touched the water, the falcon let go his hold and ascended, the razor-bill as instantaneously diving below. The nest is generally placed upon the shelf of a rock, in which the bird lays four or five eggs of a reddish brown colour, a little blotched and variegated.

The peregrine falcon appears, in different indi-

viduals, and at different ages, of so many shades in the general colouring, that it has got, perhaps, more names than any other bird; and some of those single specimens which have been shot in different remote parts of the world, without any knowledge whatever of their manners, and which have been described as peregrine falcons, in all probability belonging to other genera.

The LANNER (*Falco lanarius*), is a species about which there are some doubts; though the descriptions of it are so precise, and have been so often repeated, that if it is a variety of the peregrine it differs greatly from the general appearance of that bird; though it must be admitted that the young are described as being very like those of the peregrine. The lanner is described as being rather larger than the peregrine, though smaller than the common buzzard. It is said to measure about twenty inches in length, and upwards of forty in the extent of the wings. According to Temminck, the closed wings reach to two-thirds the length of the tail; the middle toe is shorter than the tarsus; there is a black streak below the eye, which nearly or wholly disappears in the mature birds; the eggs are of a bluish colour, while those of the peregrine are yellow; and the first and second quills of the wings have their webs very narrow. It is said to occur in many parts of Europe, inhabiting Iceland and the Feroe Islands, Denmark, Sweden, the Tartarian deserts, and breeding in the vicinity of Astrachan. It is rarely met with in this island; but it is said to breed in Ireland. In Hungary it is pretty common, likewise in Poland, Russia, Austria, and Styria. In general they build their nests in hilly situations, either among rocks, or trees and brushwood. Though the lanner is a bold bird, and was formerly used in falconry, few particulars are recorded of its manners and habits.

The HOBBY (*Falco subbuteo*), is a very handsome little bird, very much resembling the peregrine falcon in shape and also in manners, though from its smaller size it subsists on humbler prey; and it is also more gaily coloured than its more powerful conqueror. The male hobby weighs about seven ounces; and is about twelve inches in length. The following are the general markings, but they are subject to differences, both from age and in the individual. The female is considerably larger than the male, weighing two or three ounces more; and, though there is a very considerable resemblance in the general plumage, the upper part is not so dark as in the male, and the light parts have less of the rust-coloured tint. The male has the bill blue; cere and orbits yellow; irides dusky; the head and upper parts of the body are of a dark dusky brown, almost black, dashed with ash-colour; the feathers margined with pale rufous brown; over the eye a light stroke; beneath the eye a black patch, extending in a point from the under mandible down each side of the throat; chin and throat white, extending round each side of the neck, and partly encircles it, but is broken behind by dusky streaks, and the white becomes more ferruginous as it inclines backward; the coverts of the wings like the back, but the feathers more slightly edged; quill-feathers dusky black, with oval ferruginous spots on the inner webs; the breast, belly, thighs, and under tail-coverts ferruginous, palest on the former, marked with dusky streaks; the tail like the back, barred on the inner webs with rust colour, except the middle feathers; tips whitish; legs yellow; claws black. The female

weighs about nine ounces, sometimes more, and very much resembles the male in plumage, but not so dark above, and the lighter parts beneath not so ferruginous. The wings of this bird are long and pointed, but do not reach to the end of the tail when closed; the second feather is longest. In the British islands the hobby may be regarded as a summer bird of passage, and it is the only British bird of prey which is so. It arrives in England about the beginning of April, and builds its nest shortly after upon some lofty tree; but it occasionally avails itself of the deserted nest of a resident bird that builds earlier, such as the crow or the magpie. The eggs are from two to four, which appear to be the average, greatest, and least number of the tribe. The young, which have more reddish orange or bronze on the back than the old birds, are fully feathered by the beginning of September, and in October the whole depart to warmer climes. This bird is a local one with us, and confined to England, seldom reaching northward of the central heights of the island. It is the contrast of the peregrine falcon in its favourite haunts, and is a bird of the cultivated land, as that is of the open wild. Indeed, it nestles in the wood, and frequently in the depth of the forest, if not very extensive; but it hunts in the fields, and though, as it comes with the summer birds of passage, one would be apt to suppose that it should feed on them, yet the lark is its favourite game, which, even at its greatest height, it assails in the sky. That height, indeed, is often so considerable, and the one bird so intent on capturing, and the other on escaping, that their manœuvres can be seen better than most chases by birds of prey.

In this attempt to capture the lark, the hobby has to guard against two chances of escape in that bird. In the first place, if the lark can keep uppermost, so as to have complete command of the sky, the hobby can make nothing of it. But in order to get the better of this, it cannot venture upon the same bold ascent to which the more powerful falcons have recourse when in danger of being foiled by other game; for the hobby must take equal care that the lark does not get down to the ground, otherwise its escape would be equally certain. Every one must have noticed the beautiful style in which the lark comes down from the very top of the sky, by a path nearly as perpendicular as a stone does when it falls. This is a habit with the lark in the breeding season, and when there is nothing to alarm it. It may be heard on a fine spring day, showering down its enlivening song from the upper part of the sky, when itself is almost or altogether invisible, in consequence of its great elevation; but the upper sky is the place where sounds are heard to the greatest advantage, much better than they are at a quarter of the distance on the level surface. Thus the lark will hear the answer of its mate while that is altogether unheard by one attending only to the songster over head; and it will drop down like a falling stone, and run among the clods, repeating the conclusion of its stave in a softened and inviting tone. It would drop down from the hobby in the same manner, squat among the clods, and remain there so still and close that no eye could discern it, and as the hobby is just as much fitted for catching the lark as the lark is for escaping from the hobby, of course the hobby labours by every stratagem to prevent this. The chief aim of the hobby is to preserve exactly the same level with the lark, and to prevent it from getting either up or down; and if the lark were a bird of straight-for-

ward flight, the hobby would very soon capture it, both because it is a bird of more powerful wing, and because it is stimulated by hope while the lark is depressed with fear. But the lark wheels and doubles, and often succeeds in throwing its pursuer out. In time, however, it gets exhausted, and the hobby breaks across, catches it on the double, and the chase is at an end.

Notwithstanding its small size, this falcon does not confine itself to such game as larks, for it flies at young partridges, at snipes, and at many other species of birds, some of which are larger and more powerful than itself. But its great boldness, its rapidity of flight, and its power of continuance on the wing, give it many decided advantages; so that in the age of hawking the hobby was one of the pet falcons for small game; and used to afford what was considered as very beautiful sport.

The KESTREL (*Falco tinnunculus*). This is a very beautiful bird, about the same weight as the hobby, and having wings of nearly the same extent; but it is longer in body, much more slender, and feebler both in the beak and the talons. The female, as in all birds of prey, is larger and more finely formed than the male. She is reddish brown on the upper part, with arrow-head dusky spots on the head, back, and wing-coverts, and dusky bars on the tail, the last one broad, and the tips of the feathers margined with cream-colour. The quills, which are twenty-two in number, are dusky, relieved by white margins; the under part is reddish cream-colour, with indistinct dusky lines. The male, after the first year, has the head and tail grey, during which it very much resembles the female, the back brighter red, and with fewer spots, and the under part redder, with more distinct spots. The feathers on the chin are also more produced, and a black stripe proceeding from the gape, which gives the light grey above the eye the appearance of an eye-brow. The kestrel has a very peculiarly brilliant eye; the irides of which are rich brown, contrasting well with the dark stripe and pale feathers at the base of the bill and over the eye. The bill is very short, and the notch nearly obliterated, and upon the palate there are two rows of small teeth pointing downwards, and very much resembling those with which the tongues of beasts of prey are beset. The whole structure of the bird indicates that it is less adapted for pursuing winged game, tearing flesh, and pulling feathers, than those hawks which have long wings; and its habits correspond with these differences of structure. This species gets a variety of popular names, such as the stone-gall, the stannel, the wind-hover, and many others, all of which allude to the habit which it has of leaning gracefully on the air, with scarcely any motion of the wings at some periods, and with an exceedingly rapid motion at others. In these cases it is generally scrutinising the ground for nests of unfledged birds, and especially for mice; the latter of which form a principal article of its food. It is, indeed, altogether less daring in its predatory habits than any other of the falcons, and may perhaps, without much impropriety, be considered as forming a link between the falcons and the kites, and perhaps also, though to a less extent, between the diurnal and the twilight birds of prey; for it may often be seen near houses about dusk, catching the large beetles and moths, which operation it performs very dexterously with its foot, and contrives to convey them to its mouth without any pause in its flight.

There are considerable varieties of colour in some birds, which in shape and in habit very much resemble the kestrel as above described, and which, in fact, cannot perhaps be separated from it with much propriety. These inhabit the temperate parts of Europe and Asia, and also of North America, moving northward in the spring, and southward in the autumn. In the part of Europe north of the Baltic, the kestrel is a bird of passage, and seen only during the summer. It appears at the same time with the white wagtail, at the time when the crocus and the violet are in blossom; and it takes its departure in September, almost at the same time with the bird which accompanies it on its arrival. It usually constructs its nest in old ruins and towers, and sometimes in the woods, and will occasionally content itself with the deserted nest of a magpie or rook. Its own nest consists of sticks lined with wool or other soft materials. The eggs, which are four or five in number, are rather inferior in size to those of the sparrow-hawk, and are of a dirty white colour, blotched with rust-colour of various shades, and occasionally wholly covered with a deep rusty red. This species is a common inhabitant of our own country, especially about our rocky coasts, or in high or ruinous towers, proclaiming its presence by a loud tinkling and grating noise. It is frequently observed fixed, as it were, in clear weather, in one place, and fanning the air with its wings, being then very intent on its prey, such as field mice, moles, frogs, &c., which it darts upon like an arrow. It also preys on birds; and such is the determination and force with which it dashes along, either in pursuit of prey, or to escape from more powerful predatory birds, that it has been known to break through a window, and fall stunned in the middle of a room. When it preys on birds it pulls the feathers with great dexterity and neatness, but when mice are its food, it swallows them entire, and discharges the indigestible parts by the bill in castings or quids, in the same manner as the owls. It is far more familiar than most of the tribe; and very often pounces on the eall birds used by bird-catchers, and getting entangled in their nets, loses its liberty.

The kestrel is very abundant in the Deccan, or peninsular part of India; and exactly identical in both sexes with the kestrel of Europe; but Colonel Sykes, whose researches have thrown much light on the birds of India, mentions being in possession of a male bird exactly like the female of the kestrel in plumage and size, and consequently larger than the male kestrel: and, as this was shot from a party of five or six perched on the same tree, and without a male kestrel in company, he is induced to believe there is a distinct species, in which both sexes have the plumage of the female European kestrel. Remains of rats, mice, lizards, grasshoppers, and a bird, were found in the stomach of several specimens. In one stomach the remains of no less than four lizards were met with!

The MERLIN (*Falco æsalon*) is the smallest of all the British falcons, but it is one of the swiftest on the wing, the boldest in the chase, and the most easily tamed; and, therefore, in the days of falconry, it was in especial repute as a lady's hawk. The weight of the female merlin is only about six ounces, and the male is not more than five. There is considerable difference in colour between the female and young male, which resemble each other, and the male bird in full plumage. On this account they have often been described as different species, the female and young male, especially the latter, being called "stone

falcons." There is one circumstance in the habits of these birds, which, in so far, shows how likely it was for inattentive observers to fall into this mistake. The merlin, considered as a British bird, has very often been described as a migrant, appearing chiefly in the winter, whereas it is in reality a resident bird, and performs its migrations within the country. In the breeding season, it resorts to the lonely moors, where it constructs its nest in cliffs of rocks, heaps of stones, or bushes, according as one or the other may be most convenient. It resorts to those upland haunts about the same time when the summer migrants, or birds of summer movement, which winter abroad or in the lower and more fertile parts of the country, resort to the same places; and it quits these upland retreats at an advanced period of the season, following the other birds on their migration southward, though it does not appear that it quits the country along with those which winter in more tropical climates. In consequence of this movement, it is not met with in the southern or lower parts of the island during the summer; and, as there are but few persons who frequent the moors until the shooting season begins, the young merlins are then seen in their first plumage, and they are seen among stony places, which has of course got them the name of stone falcons. When the merlin comes to the margins of the cultivated land, it is one of the severest enemies of the partridge. Its eye is very keen, and its motions rapid; and thus it beats the fields with more success than even the larger hawks; and when it gets sight of a covey of partridges, it rarely departs without its bird. Notwithstanding its boldness and its power of wing, the merlin is one of the lowest-flighted falcons; and when on the cultivated lands, it is generally found skimming over the fields, or along the hedges, very close to the surface: and thus, as its prey is always below it, there is comparatively small chance of escape. In falconry the merlin was flown at ground birds, or at all events at low flighted ones, and was highly esteemed for the capture of these. Partridges have such instinctive alarm at this little falcon, that, in order to escape it, they will throng round a sportsman, and crouch at his feet.

It is probable that on the moors merlins follow the same habit; and capture on their nests many of those birds which breed in such places. Nor is it at all improbable that a sort of reprisal is made upon the merlins themselves, not in the capture of the old birds, but in the destruction of the eggs or the unfledged young, in the absence of the parent birds. From the nests that have been examined, there is reason to conclude that the broods of merlins, if all reared, would be much more numerous than those of almost any other falcon, the eggs being as many as six, while in most of the others they never exceed four, and are rarely so many. Merlins are, however, of much more rare occurrence than those whose eggs are more numerous; and thus there is some reason for believing that they must meet with casualties in the moors, in having their eggs destroyed by the hooded and carrion crows which frequent such places. The raven may also be an enemy to them; though the raven is not so much a plunderer of nests as the more feeble birds of the crow tribe; but the merlin itself would be no match for the raven; for, unless by one very lucky stroke, which it is difficult to get upon a bird so crafty as the raven, even the peregrine, or the goshawk, is not a match for this strong and determined bird, or at all events not more than a match.

The following are the most frequent colours of the male of this species: the bill of a bluish-lead colour, with the cere at the base greenish yellow, and the irides of the eyes dusky-brown; the naked parts of the legs yellow, and the claws black; the crown of the head is dusky brown, streaked with black down the shaft of each feather; on the back of the head the feathers are white at the base, and tipped with rust-colour; the middle of each feather black at the point; the back, scapulars, rump, and wings cinereous lead-colour, each feather marked with a long slender line of black down the shaft; greater quills black; the inner webs marked with many oblong white spots; those next the body are coloured like the back on the outer webs; the inner webs spotted as the others; the two first feathers are much indented towards the point of the inner web, as if cut with a pair of scissors; the third feather rather exceeds the second in length, and is the longest; the throat is nearly white; breast, belly, sides and thighs rust-coloured, streaked with a dusky hue; vent and under tail coverts pale rust-coloured; the under wing coverts are rufous brown, with round white spots on each web; tail like the back, crossed with six or seven bars of black; the end black for almost an inch, slightly tipped with white; legs yellow; claws black.

The female merlin, and the male in the immature plumage, or that which has been designated the stone falcon, is different from the above; and as the bird is one of considerable interest we shall quote the accurate description of one, an immature male, by Mr. Foljambe:—"Length of the bird in question is about twelve inches; bill lead-colour; cere and irides yellow; the feathers on the crown and back of the head brownish cinereous, with black shafts; throat cream-colour, extending in a very narrow line over the eyes; cheeks, back of the neck, and breast, rufous, with longitudinal spots of brown; thighs pale rufous; with a few very narrow lines of a brown colour pointing downwards; the back scapulars and wing coverts bluish-cinereous, with black shafts to the feathers; the prime quills have their inner webs marked with six large white spots, the base edged with white; the outer web of the first feather is scalloped with white; the second and third feather the longest; the wings when closed reach within an inch of the end of the tail; the tail is bluish-cinereous, with four black bars, that at the end an inch in breadth, the others narrower; the tip white; the under side of the tail white, barred as above; the legs and toes yellow and slender."

The merlin is an exceedingly bold bird; and when it is in the lower cultivated parts of the country, it does not hesitate to pursue little birds in gardens, and even to drive them into houses; nor is this all, for it will sometimes make a dash at a bird in a cage, even though the cage be inside a house; and there are instances of its having forfeited its liberty in consequence of its daring in this way. Even when captured full grown, the merlin is exceedingly docile and easily tamed; and if duly fed, it is one of the most gentle creatures imaginable. Indeed it is a very general truth with regard to birds of prey, and the same holds good in the case of mammalia, that the boldest preys are the most easily tamed, and the most gentle when they are tamed. There is no more remarkable instance of this in birds, than the golden eagle and the brown owl. The owl, even though taken young, will snap with its beak, erect its feathers, and defend itself, or at all events endeavour to escape when-

ever it is approached; but the eagle will so far enter into companionship as to follow its master, to conduct itself decorously in a dining-room, and even to amuse itself with those that are kind to it. The case of the dog is a parallel one in respect of mammalia. Of all animals of that class the dog in a state of nature is decidedly the most courageous; and there is certainly no animal whatever which shows nearly the same degree of attachment as the dog does when domesticated. This is a very curious point in the physiology of animals, as it tends to prove, and actually proves, that if there is the requisite degree of energy in the animal, this energy may be turned either to good purpose or to bad, according to circumstances. In the whole of the irrational animals there is not, we believe, a single exception to this; and it holds equally true in the case of man, there being no question that those who under favourable circumstances have displayed the most noble virtues, would, under circumstances of an adverse nature, have been the most daring in crime; and there is just as little doubt that they who have disgraced human nature by the most desperate atrocities, would, under proper treatment, have been the best benefactors and the noblest ornaments of society. This fact embodies in it volumes of instruction, far more important than any mere description of a bird or of any other animal, or any detail of a fact, of what nature soever; because it goes at once to the root of the question of the proper management of living nature, rational and irrational, so as to turn it to the greatest possible advantage. It does more than this: for herein the Almighty himself vindicates his own law, and establishes the truth of that benediction which he pronounced upon the new made world—"And God saw everything that he had made; and, behold, it was very good."

If we could carry this short declaration along with us in all our researches in natural history, the advantages would be incalculable, and we should not, as we too frequently do, content ourselves with a mere description of the external appearances of animals, as if they were stocks or stones, neither should we wage against them a war of extermination on account of some fancied noxiousness or positive evil. "Behold, it is VERY GOOD" is the declaration of God himself, over everything animate or inanimate within the whole bounds of the creation; and as this is an express, primary, and infallible declaration by Him to whom every atom of matter in every possible connection, throughout all space and during all time, is most intimately known, how shall we, how can we, how should we, escape the vengeance of His just displeasure, if we cast it behind us when we go forth to survey His works, and dare to set up, instead of this eternal and infallible standard, some paltry caprice of our own?

Be what the creature will, it has been declared that it is "very good;" and it is our duty, the very purpose for which we were made, to find out the proper answer to the question, "Good for *what*?" Weeds overrun the garden, and choke those artificial plants which man has sown or planted for his use; but "they are very good:" they speak to the sluggard in language more forcible than all the laws which ever were enacted by human legislation; and impress upon man that if he is to profit by the bounty of the earth, he must be diligent in performing those labours which are necessary for the security of this bounty. Insects of various kinds, and in different stages of their

multiform existence, are particularly annoying to mankind both within doors and without. But they also are "very good," and proclaim with voices louder than all the heralds upon earth, the necessity of cleanliness and care. In this manner we may go over the whole catalogue both of vegetable and of animal pests as they *are usually* called, and we should be able to show in the most satisfactory manner, that they are all equally deserving of that benediction which was bestowed upon them at the first.

There is in this much to reprove our ordinary conduct, and as much to teach us how we may, if we only will, listen to the reproof, and profit by the lesson. We are hereby reproved for presuming to set up our limited knowledge and experience as a standard of judgment; and we are taught that there is use and purpose in every created thing, however offensive or injurious it may appear, and that it is both our duty and our interest to find out this use. Indeed, to find out the uses of the productions of nature is the grand and only rational purpose of the study of natural history; and if we have not this in view, the study is an idle waste of time, no better than any other inoffensive dissipation; and the man who merely knows the external distinctions between plants in a *hortus siccus*, or animals in a museum, and can call them by all the different names which they have got in different countries and by different individuals, is really of no more use, and therefore has no more merit, than a man would have who should make a collection of all the different forms and kinds of buttons that ever were worn, and be able to tell the names of the makers and first wearers. One cannot help regretting that, while this perfectly insignificant counterfeit of natural history has occupied the attention of so many, the really important portion of the subject should have been so much neglected; and yet this has been undoubtedly the case in almost every department of nature. There are, for instance, innumerable collections of shells; but who can tell anything about the animals by which those shells were made and worn? So are there many collections of foreign birds; but who can tell anything about their manners? Even in this genus *falco*, the species with which we are familiar in this country have been confounded, and the characters misrepresented, down to a comparatively recent time; and when we come to those which are foreign to Europe, all that we can, except in a very few instances, present, is a mere catalogue of names, and a list of sizes and colours. Strange productions of nature are bought with great avidity as curiosities; but it would be a very good rule strictly to prohibit the introduction of any new plant or animal, unless its history came along with it. We require a character with a strange human being, and why should we not also require a character with a strange beast or a strange bird?

THE LITTLE KESTREL (*Falco tinnunculoides*) resembles the kestrel in its form and habits, but it is smaller in size. The upper part is rust colour, or russet; the top of the head and sides, and back of the head, ash-coloured; the coverts of the wings, the rump, and the tail-coverts, bluish-ash; the tip of the tail white, within which there is a large bar of black; the under part bright reddish, spotted and lined with black; the beak bluish, the feet yellow, and the claws white. This species inhabits rocky situations in the eastern part of Europe, but is rarely seen in

the western parts, and never, so far as we have any record, in the British islands.

RED-FOOTED FALCON (*Falco rufipes*). This is also a small species, and belongs to eastern Europe, but it appears to be rather more discursive than the one last mentioned, and we believe it has occurred in some parts of England as an exceedingly rare straggler. A specimen of this bird, which had been shot near Doncaster, was exhibited before the Committee of Science of the Zoological Society of London on the 27th of November, 1832. Its characters are: bluish ash on the upper part; breast and belly of the same colour, but paler; lower part of the belly, thighs, and under tail-coverts, bright reddish; beak black; irides and feet red; and claws yellow, with black tips. The length of the male bird is about ten inches and a half. The female is a little larger, and has the nape marked with reddish lines; the sides of the head and the throat bright reddish; the under part and the thighs reddish brown, with black markings. The plumage of the young is intermediate between that of the mature male and the mature female, but differs from both, and this has led to some little confusion. They have the cheeks and throat white; the breast and thighs spotted with brown; ten or twelve brown bars across the tail; and the feet yellow, and the claws whitish.

The species of which we have given some account include (as nearly as we can estimate) all the true falcons which are native and resident in Europe, not of course including the jerfalcon, which remain still to be noticed, and which are in some respects the most splendid birds of the genus. Of the foreign ones we can only give a mere list; and, from the long confusion of the European species, which are so generally known, and which were long so highly esteemed by the leading people of all countries, it would be too much to say that this list has many pretensions to correctness. Very likely the same species, of different sexes or ages, has been named and described as two; and very likely, also, there are many species hitherto unknown to us.

THE AMERICAN SPARROW HAWK (*Falco sparverius*). This is a bird of many names; it is the little falcon, the St. Domingo falcon, the New York merlin, the American merlin. The female is eleven inches long, and twenty-three inches from tip to tip of the expanded wings; the cere and legs yellow; bill blue, tipped with black; space round the eye greenish blue; iris deep dusky; head bluish ash; crown rufous; seven spots of black on a white ground surround the head; whole upper parts reddish bay, transversely streaked with black; primary and secondary quills black, spotted on their inner vanes with brownish white; whole lower parts yellowish white, marked with longitudinal streaks of brown, except the chin, vent, and femoral feathers, which are white; claws black. The male sparrowhawk measures about ten inches, and is about twenty-one inches in the stretch of the wings; the whole upper parts of the head are of a fine slate blue, the shafts of the plumage being black, the crown excepted, which is marked with a bright reddish spot; the slate tapers to a point on each side of the neck; seven black spots surround the head, as in the female, on a reddish white ground, which also borders each sloping side of the blue; line over and under the eye and chin, white; femoral and vent feathers yellowish white; the rest of the lower

parts of the same tint, each feather being streaked down the centre with a long black drop, those on the breast slender, on the sides larger; upper part of the back and scapulars deep reddish bay, marked with ten transverse waves of black; whole wing-coverts, and ends of the secondaries, black, tipped with white, and spotted on their inner vanes with the same; lower part of the back, the rump, and the tail-coverts, plain bright bay; tail rounded, the two exterior feathers white, their inner vanes beautifully spotted with black; the next bright bay, with a broad band of black near its end, and tipped for half an inch with yellowish white; part of its lower exterior edge white, spotted with black, and its opposite interior edge touched with white; the whole of the others are very deep bay, with a single broad band of black near the end, and tipped with yellowish white; cere and legs yellow; orbits the same; bill light blue; iris of the eye dark, almost black; claws blue black.

This species is not confined to the United States, and indeed it is a native of the warm countries rather than the cold ones, being more abundant in the southern states of the American Union than in the northern, and being especially numerous in St. Domingo or Hayti, and not unknown on the continent of South America. In all probability, indeed, its colours and character may vary in different parts of the vast range of latitude over which it extends, so that it is possible that several of those species about the same size, which have been named as occurring in different parts of the American continent, are nothing more than climatal varieties of this one; and as it is one of the few foreign species of which the characters are tolerably well known, we shall quote from Wilson a short passage descriptive of its manners:—

‘ It flies rather irregularly, occasionally suspending itself in the air, hovering over a particular spot for a minute or two, and then shooting off in another direction. It perches on the top of a dead tree or pole, in the middle of a field or meadow, and, as it alights, shuts its long wings so suddenly, that they seem instantly to disappear. It sits here in an almost perpendicular position, sometimes for an hour at a time, frequently jerking its tail, and reconnoitering the ground below, in every direction, for mice, lizards, &c. It approaches the farm-house, particularly in the morning, skulking about the farm-yard for mice or young chickens. It frequently plunges into a thicket after small birds, as if at random, but always with a particular, and generally with a fatal, aim. One day I observed a bird of this species perched on the highest top of a large poplar on the skirts of the wood, and was in the act of raising the gun to my eye, when he swept down with the rapidity of an arrow into a thicket of briars about thirty yards off, where I shot him dead, and, on coming up, found a small field-sparrow quivering in his grasp. Both our aims had been taken at the same instant, and, unfortunately for him, both were fatal. It is particularly fond of watching along hedge-rows and in orchards, where small birds usually resort. When grasshoppers are plenty, they form a considerable part of its food.” Wilson adds a very characteristic instance of the delicacy of taste of this falcon in respect to its food:—“ Though small snakes, mice, lizards, &c.,” says he, “ be favourite morsels with this active bird, yet we are not to suppose it altogether destitute of delicacy in feeding. It will seldom or never eat of

anything that it has not itself killed, and even that, if not (as epicures would term it) *in good eating order*, is sometimes rejected. A very respectable friend, through the medium of Mr. Bartram, informs me, that one morning he observed one of these hawks dart down on the ground, and seize a mouse, which he carried to a fence-post, where, after examining it for some time, he left it, and, a little while after, pounced upon another mouse, which he instantly carried off to his nest, in the hollow of a tree hard by. The gentleman, anxious to know why the hawk had rejected the first mouse, went up to it, and found it to be almost covered with lice, and greatly emaciated! Here was not only delicacy of taste, but sound and prudent reasoning. If I carry this to my nest, thought he, it will fill it with vermin, and hardly be worth eating.

“ The blue jays have a particular antipathy to this bird, and frequently insult it by following and imitating its notes so exactly, as to deceive even those well acquainted with both. In return for all this abuse, the hawk contents himself with, now and then, feasting on the plumpest of his persecutors, who are, therefore, in perpetual dread of him; and yet, through some strange infatuation, or from fear that, if they lose sight of him, he may attack them unawares, the sparrow-hawk no sooner appears than the alarm is given, and the whole force of jays follow.” This tendency which small birds have to crowd round and annoy their more powerful enemies, is a curious point in natural history, and one the *rationale* of which is not very easily understood; the more so, that it does not hold in the case of the very powerful birds of prey. Nobody we presume, has seen a flock of birds, either great or small, following and annoying the golden eagle, the jerfalcon, or even the peregrine. It is true that these prey less frequently upon little birds than the smaller hawks; and therefore they do not stand so directly in the character of enemies; but still, as was observed by Wilson, and is reported by American naturalists generally, the ospreys crowd round and annoy the white-headed eagle. The grand object seems to be, so to distract the attention of the enemy, as that he shall not be able to single out any one individual as his victim, but wear himself out in a crowd, the members of which are all equally attractive. This point, if duly worked out, might help to explain the curious subject of *fascination*, which some animals appear to possess over their prey.

THE PIGEON FALCON (*Falco columbarius*) is another American species, rather larger than the preceding one, and of a more bold and intrepid character. True to this character, it is a more northerly bird, breeding and rearing its young as far to the north as the inhospitable rocks which surround Hudson’s Bay, and not appearing in the United States till the month of November, when the small birds congregate. “ When,” says Wilson, “ the reed-bird, grakles, and red-winged blackbirds congregate in large flights, he is often observed hovering in their rear, or on their flanks, picking up the weak, the wounded, or stragglers, and frequently making a sudden and fatal sweep into the very midst of their multitudes. The flocks of robins and pigeons are honoured with the same attentions from this marauder, whose daily excursions are entirely regulated by the movements of the great body on whose unfortunate members it fattens. The individual from which the present description was taken, was shot in the meadows

below Philadelphia, in the month of August. He was carrying off a blackbird from the flock, and, though mortally wounded and dying, held his prey fast till his last expiring breath, having struck his claws into its very heart. This was found to be a male. Sometimes when shot at, and not hurt, he will fly in circles over the sportsman's head, shrieking out with great violence, as if highly irritated. He frequently flies low, skimming a little above the field. I have never seen his nest.

"The pigeon hawk is eleven inches long, and twenty-three broad; the whole upper parts are of a deep dark brown, except the tail, which is crossed with bars of white; the inner vanes of the quill feathers are marked with round spots of a reddish brown; the bill is short, strongly toothed, of a light blue colour, and tipped with black; the skin surrounding the eye greenish; the cere same; temples and line over the eye lighter brown; the lower parts brownish white, streaked laterally with dark brown; legs, yellow; claws, black. The female is an inch and a half longer, of a still deeper colour, though marked nearly in the same manner, with the exception of some white on the hind head. The femoral or thigh feathers in both are of a remarkable length, reaching nearly to the feet, and are also streaked longitudinally with dark brown. The irides of the eyes of this bird have been hitherto described as being of a brilliant yellow; but every specimen I have met with yet had the iris of a deep hazel. I must therefore follow nature in opposition to very numerous and respectable authorities.

"I cannot, in imitation of European naturalists, embellish the history of this species with anecdotes of its exploits in falconry. This science, if it may be so called, is among the few that have never yet travelled across the Atlantic; neither does it appear that the idea of training our hawks or eagles to the chase ever suggested itself to any of the Indian nations of North America. The Tartars, however, from whom, according to certain writers, many of these notions originated, have long excelled in the practice of this sport; which is, indeed, better suited to an open country than to one covered with forests."

The different characters of this and the preceding species of the American falcon, throws some light upon the differences of character in those birds, answering to differences in their geographical distribution. This is a more northerly species than the former, not being found at all in the tropical parts of America, and not in the temperate parts, except during the winter. Whereas the former is found most abundantly in tropical climates, and does not at all occur in the regions of the extreme north. This species is also a far more bold and determined bird than the other, and more decidedly a preyer upon the feathered tribes and the smaller mammalia. Something of the same kind occurs on the eastern continent. The small falcons which are most plentiful in the south and east of Europe, are very abundant in Asia; but the peregrine, notwithstanding its powers of flight, and its disposition to range, is by no means common there, and the jerfalcon is altogether unknown.

Hence we see that, in the polar countries, the falcon tribe take after the golden eagle as the grand type of all the tribes, while those in the tropical countries take more after the vulture. The former, in proportion as they are more northerly in their

proper habitat, prey more habitually upon warm-blooded animals, and kill their prey for themselves; the latter, in proportion as they are more equatorial in their peculiar habitat, feed more upon carrion and reptiles. In this there is a very beautiful adaptation. The equatorial pastures may be said to be perennial, and therefore their animals are mostly stationary or resident the whole year, and there is no particular period or season at which their numbers require to be thinned. Therefore, in as far as birds are concerned, scavengers only are wanted; but because the plains are alternately luxuriant with herbage, and burnt up with drought, we find the larger beasts of prey stationed there to keep down the superabundance of the grazing mammalia. In the polar countries, on the other hand, very many of the birds are migrant, and the winter is extremely severe, so that the numbers even of the resident birds, and also of the smaller ground mammalia, require to be periodically thinned. Did our limits permit, it would be easy to follow out this comparative view with reference to almost the whole of the animated inhabitants of the polar and tropical lands; but we must leave the farther prosecution of the subject to the reader, and proceed with our list of the remaining falcons, of which we shall not in general give English names, as they are not very applicable.

Falco fusco-cærulescens. This species, as its name imports, is brown and blue. The upper parts are bluish with brown markings; and the upper tail-coverts are streaked with white. The coverts and quills of the wings are brown; the under parts reddish with brown spots; the throat and breast brown with white streaks; the beak greenish-ash, and the feet ash-coloured. The length is about eleven inches, and the bird is an inhabitant of North America.

Falco ophiophagus. This name implies that the bird feeds upon snakes; but very little is known respecting its manners. It is described as being blackish-ash on the upper part, and greyish-white on the under; the top of the head, the throat, and sides of the neck reddish; the greater wing-coverts have white tips, but the rest of the coverts of the wings are black. The beak blackish-blue, and the naked parts of the feet blue. The upper mandible has a tooth towards the middle; and the lower a slight notch towards the point. The length is about thirteen inches, and the bird is found in North America, but its habits are not known.

Falco albicollis. The neck of this species, as the name imports, is white, which is also the colour of the head, and the under part of the body. The upper part is varied with white and blackish; the beak is ash-coloured, and the feet yellow. The bird is thus described; but there are two doubts respecting it,—first, whether it be a distinct species; and, secondly, whether, granting that it is so, it be a falcon.

Falco nigricollis. The general plumage is a mixture of black with reddish and white; the head, neck, and tips of the greater coverts are quite black; and the feet are yellow. Like the species immediately preceding, it was obtained from the northern parts of South America; but whether it be a distinct species is not known.

Falco bidentalis. This species is named from having the bill double-toothed. It is a native of tropical America. The upper part is of a grey colour, brightest on the head and cheeks; the under

part reddish, streaked with white. The throat and under tail-coverts white; the beak ash-coloured, and with two strong teeth on each side; the cere and naked part of the feet are yellow; and the length is about fourteen inches. The female is marked all over on the under part with small blue spots. The young are brown streaked with white on the upper part, and white streaked brown and reddish on the under.

Falco superciliosus. This is also a South American species, and has a naked space under the eyes. It is described as being brown on the upper part, and having the rump marked with black and white; the lesser coverts of the wings are ash-colour streaked with black; and the greater coverts have two white bands near their terminations; the under parts are whitish waved with brown; the eyebrows are projecting; the cheeks naked; the beak black; and the cere and feet yellow. This species, like many of those described from single museum specimens, is very doubtful.

Falco femoralis. This is also a South American species, and is described as a native of Brazil. The upper parts are bright brown; some of the wing coverts are marked with bars of reddish ash; the greater coverts are black, with white bars across at their bases, and red tips; the primary quills have white tips; there are large black mustachios; the forehead, cheeks, thighs, middle of the belly, and under tail coverts are bright red; the sides of the belly and the flanks are purplish black; the beak blue; the cere yellow; and the feet ash-coloured; the length is about twelve inches.

Falco diodon is another Brazilian species. The upper parts are slate black; the nape, the sides of the head, and the cheeks, deep ash colour; the throat white; the under parts greyish ash; the thighs reddish; the wings and tail barred with black; the beak ash-coloured, with two strong teeth to the upper mandible; the irides and feet yellow. The length is about eleven inches. The female has the markings less distinct. The immature birds are brown on the upper part, with streaks and bands of a darker colour; they are spotted with blackish on the under side; and have their thighs reddish.

Falco meridionalis. Brown on the upper part; head streaked with red and black; coverts streaked with whitish; under parts whitish with ash-coloured streaks; bill black; cere and feet yellow; length about sixteen inches.

There are several other species found in South America which are described as falcons, but nothing is known of their manners. There is as little known respecting the falcons of Africa, and indeed of all the warmer parts of the world, and the lines of distinction between them and the other birds of prey are very faintly marked, but we shall give a few of the names.

Falco melanopterus. Reddish on the upper part, with black and ash-coloured markings on the wings; under part white; beak blackish, and feet yellow. Length about fourteen inches.

Falco Aldrovandii is a small species, only between ten and eleven inches in length. It has been found in Java. The upper part, and the quills next the body, blackish blue; the wing coverts black spotted with red; the lower part reddish; the beak bluish; and the cere and feet yellow.

Falco chicqueca. Another small species very common in the interior parts of India. Upper part

bluish; nape and crown reddish; under parts white streaked with ash colour; the extremities of the tail feathers reddish with a black band; beak, irides, and feet yellow.

Falco lophates. Upper part, thighs, and belly of a black colour with blue reflections; some of the coverts of the wings marked with white spots surrounded by a reddish margin; a white band on the breast, the ground colour of which is maroon brown; a large crest on the hind head; the beak blue, with the edges of the mandibles yellow; the legs ash-coloured. The length about thirteen or fourteen inches. Inhabits India, and other parts of south-eastern Asia.

Falco cirratus is another Indian species with a crest. Upper part black; a long crest of a yellow colour on the nape, which parts in two and hangs over each side of the neck; the tail feathers banded with ash colour; the under part white lined with black; beak blue; irides, cere, and toes yellow; the tarsi feathered down to the toes.

Falco ruficollis. Understood to be an African species. The upper part brown; the head streaked with reddish brown and black; the tail feathers barred with white; the under part dull white marked with brownish ash and black; the throat white; the bill black; and the feet yellow. Length about fifteen inches.

Besides those of which we have given the names, there are many falcons of which specimens have been brought from remote parts of the world,—from South America, from Africa, from Asia, north and south, from Australia, from New Zealand, and from some of the remote isles of the Pacific. Indeed it should seem that no part of the world is without its falcon; though it is only in Europe and western Asia, that falcons have at any period been trained so as to be of the smallest service to the human race; and therefore those ones of which specimens are obtained from remote countries are birds of little or no interest, except to mere collectors; and in the case of some of them the collecting is as likely to be productive of error, as of truth. This is especially true of falcons and all other birds which are, or which at least some time ago were brought from Southern Africa; as any one can find by examining Levaillant's birds of Africa, many of which are not African birds at all; and when skins of animals are brought from dealers at the Cape, the purchaser would require to ascertain very correctly whether they are or are not natives of that quarter of the world; because from the Cape being a sort of *entrepôt* between Europe and the East, all oriental commodities and the skins of animals among the rest are of course to be had in abundance there. For these and other reasons we shall not extend the catalogue of the falcons properly so called; but we may remark in passing that the whole of those foreign ones appear to fall into three classes, of which the peregrine, the hobby, and the kestrel appear to be the European types, and, according as any foreign species resembles the one of these more than either of the other two, we may expect a correspondence in its habits to that which it more nearly resembles; and perhaps, in the present state of our knowledge, this is the best key which we have to the general characters of those birds. It must, however, be received with some modifications, because, as we have said, the characters of all the genus appear to be softened in proportion as their locality is nearer to the equator. We

shall now proceed shortly to notice the remaining, smaller and more local division of this genus of birds :—

JERFALCONS (*Hierofalco*), Cuvier. This (for though it is probable that there are three distinct species, yet we are well acquainted with only one,) is the most powerful, and in some respects the most interesting of all the falcons. In the structure of its wings it resembles them exactly ; being adapted for rising against the wind, and not floating by the wind's motion. The beak, however, differs from that of the other falcons, in being almost without a tooth, having merely a bend downwards near the tip of the upper mandible, and a very slight notch in the under. It is in fact, at least in so far as its cutting edges are concerned, more like the beak of an eagle than that of a falcon ; but it still retains the curvature from the base, and in its general structure it is a very powerful instrument, more powerful perhaps than the beak of any other genus, not so much on account of its greater size as of its superior strength, and the firmness of its texture.



Jerfalcon.

This form of beak in the jerfalcon shows how unsafe it is to form our general notions of birds upon the structure of any general organ. It has sometimes been supposed that, in consequence of this want of a tooth in the beak, the jerfalcon was allied to the vulture ; and some have gone so far as to say that the first part of its compound name "jer" is nothing else than *geyer*, the name of a vulture in the north Alps, altered in the pronunciation. Whether this be or be not the case, is of little consequence ; but the probability is that it is not true ; because there is no vulture in the native locality of the jerfalcon, and we believe there never was an instance of a jerfalcon in a state of nature appearing in a vulture's country, even as a straggler. There could therefore be no means by which the rude people of former times could so compare these two birds, as to decide upon their similarity or their dissimilarity ; and therefore we must regard such observations as this in no other light than that of fancies, which systematic naturalists are sometimes apt to indulge in when they know not very well what else to say. The truth is, that there is perhaps no bird of the whole rapacious order that differs more from the vulture in its manners, and also in its geo-

graphical distribution, than the jerfalcon does. As a diurnal preyer, the jerfalcon tenants the arctic margin of the land, and has to maintain its existence and find its food amid the storms and the comparative desolation of the north. And we may add, that there is no creature within the whole compass of the animal kingdom more admirably adapted to the scenes which it tenants, and the atmosphere through which it has to make its way. Its bones are more compact and strong than those of any other known bird, being of greater specific gravity, volume for volume, than those of the golden eagle herself, though she too is a dweller in stormy places, and has to beat the wilderness far and wide for her subsistence. If we take those bones singly, each of them is a perfect model of the maximum of strength and the minimum of their materials ; and if we look at them in their connections, their articulations, and those levers and purchases which they afford to the tendons of the muscles, there is more of the principles of mechanics to be learned from the skeleton of a jerfalcon than from all the combinations of materials which were ever brought together by human engineers. Then, if we proceed to examine this matchless skeleton as it is clothed with flesh, enwrapt in skin, and protected and furnished with feathers we find in this bird one of the most striking, one of the most irresistible proofs of infinite wisdom in contrivance, and infinite power in execution. Viewed in this light, the jerfalcon, clutching the summit of the ice-clad rock, or breasting the northern tempest when it drives dark as midnight with snow, proclaims as loudly the existence and the attributes of her Maker, as if they were written in a book, in the most forcible terms, and in all the languages under heaven.

We shall afterwards say a few words on the probability of a difference of species, or at all events a variety in this most noble bird ; but we are in the mean time treating of it as the one well-known jerfalcon, *Falco islandicus*, of most authors ; and while treating thus generally we shall quote the following passage from Mudie's Feathered Tribes of the British Islands : " It has not been positively ascertained that the jerfalcon breeds in any part of the British islands, neither can the fact of its so breeding be denied, because, in all places, its nest is situated so high among the crags of the rocks, that it is difficult to be seen, and still more difficult to be reached. But, if it does not breed there, it pays occasional visits to the northern and western isles, more especially to those places of them that abound with rock doves ; and few sights can be finer than that of the jerfalcon driving through a flock of these. When the falcon comes within sight of her prey, she bounds upwards, every stroke of her wings producing a perpendicular leap, as if she were climbing those giant stairs into which nature moulds the basaltic rocks ; and when she has 'got the sky' of her prey to a sufficient height for gaining the necessary impetus, her wings shiver for a moment as she works herself into perfect command and power, and to the full extent of her energy. Then down she dashes, with so much velocity, that the impression of her path remains on the eye, in the same manner as that of the shooting meteor or flashing lightning, and you fancy that there is a torrent of falcons rushing for fathoms through the air. The stroke is as unerring as the motion is fleet. If it take effect in the body, the bird is bruised and her hunt is over ; but if a wing only is broken, the maimed bird is allowed to flutter to the earth, and another is marked

out for the collision of death. It sometimes happens that the mountain crow comes in for the wounded game; but in order to do so it must proceed stealthily along the ground, for woe betide it if it rises on the wing, and meets the glance of the falcon. The raven himself never scoops out another eye, if he rises to tempt that one; and it is by no means improbable that, in the early season, in those cold northern countries, when the lambs are young and the flocks weak, and the crows and ravens prowl about blinding and torturing, the jerfalcon may be of considerable service to the shepherd."

The jerfalcon is large, strong, exceedingly compact, and very firm in its plumage. The length of the male bird is about twenty-two inches, and the stretch of its wings about four feet. The female is two or three inches longer, and proportionally greater in the extent of the wings. The ground colour of the whole plumage is white, with narrow bands of brown on the upper parts and the tail, and tear-shaped spots of the same colour upon the under part of the body, interspersed with lines and arrow-point spots still of the same colour. The tail, which consists of twelve rounded feathers, is rather long, of a dark-greyish colour, with black shafts to the feathers, and marked across with dusky bars, generally about twelve in number. The colours on the upper part of the male bird are, at all ages, darker than those of the female; and the very old females become almost white. It is probable also that, as is the case with the ptarmigan, which forms part of the jerfalcon's winter food, the white may become more pure during the winter season. The beak is of a bluish colour, but the tip is black, and so are the claws. The feet, the cere, and the naked space round the eyes are bluish yellow. In the young bird they incline more to blue, and the upper part is also much more dusky, so that, as has been the case with many other falcons, the old and the young have been sometimes described as different species. The tarsi, which are very short, and have reticulated scales, are feathered for the upper part of their length. The feet and claws are not remarkably large; but the action of the joints is exceedingly powerful and the articulation beautiful.

The extreme north of Europe, and also of some parts of Asia, is the native locality of the jerfalcon. On the continent it is not met with to the southward of the Baltic, and it is rare in the southern parts of Sweden. Indeed, as it is completely a bird of the wilds, it seldom makes its appearance over cultivated lands in any country. It is not, however, a woodland bird, but a tenant of the wild rocks; and though it is plentiful in Norway, Iceland, in which there are no woods, is understood to be its head quarters, and the country where it attains the largest size, and has the greatest power,—if indeed there be not in Iceland a species, or variety, of greater size and strength, and whiter in the colour than the one which is met with in continental Europe.

The jerfalcon certainly does combine some of the habits of the golden eagle with those of the falcons properly so called; and the structure agrees with this habit. Ascent and descent, the former to gain power, and the latter to put that power in execution, are the chief motions of the eagle; and for this purpose the eagle has great strength and capacity of action in the tail; so that it works for ascent or descent, something in the same manner as the wings work for progressive motion. The tail of the jer-

falcon is in this respect very similar to that of the eagle; it is capable of being spread very wide, and of striking either upwards or downwards against the air, with very considerable force. At the same time, the very different structure of the wings gives this falcon a far greater command of the air than the eagle. The eagle can do execution only when her prey is on the ground; and she cannot rise to windward in the same style as the falcons. The jerfalcon on the other hand can strike her prey either in the air or upon the ground, and with the same effect in both cases. It is probable that the use of these different powers predominates at different seasons. In summer the places which the jerfalcon inhabits are full of birds, snipes, lapwings, and other birds of rapid flight, besides the native gallinaceous birds of the northern wilds. Some places too, even pretty far north, have their rocky shores thronged with rock doves (*Columba livia*); and during the summer season these are generally stirring. At this season, therefore, it is probable that the jerfalcon lives chiefly upon birds, and kills her prey in the air; but that when winter comes she has to take more to the habit of the eagle. At that season there are comparatively few birds to be seen on the wing; though there are a good many ground birds, as well as alpine hares, and other small mammalia; and, though we cannot be certain of the fact, it is highly probable that during this season the jerfalcon preys upon these.

In farther proof of this, it may be mentioned, that it is in summer and autumn, rather than after the winter has set in, that the jerfalcon is discursive, and found without her arctic territory; and this fact shows that she must be supported during the winter by food which she finds at home; and that which we have mentioned is the principal part of what her dominions then furnish. In this again there is some resemblance to the golden eagle. The upland places which the golden eagle frequents, stand to the low countries around them in pretty nearly the same relation as the native haunts of the jerfalcon stands to the temperate countries farther to the south. And it is matter of common observation to those who reside near the abodes of eagles, that they seldom or never find those birds beating over the lower valleys in the winter. Indeed, they are rarely seen at that season; but as we know that eagles stand many winters, they must have some food, notwithstanding their power of abstinence; and this food they must obtain in the mountains. The jerfalcon is, in all probability, as long lived a bird as the eagle; and though she is probably as capable of enduring hunger as the eagle, we can scarcely suppose that she can be without food for the whole length of a Lapland or an Iceland winter, which is any thing but a short one, and consequently she also must find what food she acquires in the wilds during this season.

Those circumstances, which we believe have seldom if ever been adverted to, are worthy of attention, as descriptive of the leading habits of perhaps the two most interesting birds in the whole of the feathered catalogue. They are both tempered to the utmost violence of the storm; and they remain most constantly in the home of that storm during the season of its greatest violence. This is very different from the birds of warmer countries; and from the summer visitants of the colder ones; but it is common to the gallinidæ of the northern regions and the mountain tops, as well as to the powerful birds of prey which winter there. The great owls of the north should

probably also be included in this peculiar class of birds; but this is not the place to notice them; and, therefore, we shall reserve what we have to say concerning them till we come to the article OWL, in which we shall take occasion to examine the peculiarities of the whole family of the *Stringidæ*, as they are sometimes called in modern nomenclature.

In their excursions, even at that season when they spread the most, the jerfalcon is rarely if ever seen in England, and we believe they are equally rare in the lowland and well-cultivated parts of Scotland. They appear, however, not unfrequently in the Shetland islands, rather less so in the Orkneys, and less so still in the western islands, and the west and north-west islands of Scotland. When they do make their appearance there, however, they are easily known from any other birds of prey by their colour, their size, and the splendid style of their flight. We have been informed by those who have been much in the open air, and were attentive to what was going on in these places, that jerfalcon is nearly white, and others much darker, are occasionally seen, though of course not together; and that the paler-coloured ones are larger, bolder, and of more powerful wing. This would lead one to conclude that the pale ones are from Iceland, and those of a darker colour from Norway, by the way of the northern isles; and, as the rate of flight in a jerfalcon is in all probability not less than one hundred and fifty miles in the hour, none of the distances which we have mentioned would be very fatiguing. We are still, however, in want of more information respecting the habits of these birds; and also respecting another species, darker coloured than either of these, which is said to occur in the northern parts of the American continent.

We omitted to mention that jerfalcon nestle on the ledges or in the clefts of the rocks; that the pair are generally near each other during the time that they have young; and that the number of eggs varies from two to four. Jerfalcon is the most esteemed of the whole race, though the most difficult to train; and, therefore, they were, and in some places are still, in great request. Even as far from their native north as Persia the female was used in bringing down the most powerful birds, such as the stork and the crane, while the male was employed against the heron, the kite and the crow. But we must end this part of our subject, as we have not space fully to enter into its details.

FALCONRY. The natural history of the falcons would be incomplete without some slight notice of the use of them in the art of falconry, and the training of them for that art, even though, as a regular sport, it may be said to be now wholly extinct in this country, and very much on the decline in every other. The fact is, that of all engines, so to call them, used for the capture or the killing of game, falcons are by far the most expensive, and require the most skilful management, both in training at the first, and in exercising them so as to keep them in training.

The art is not a modern one; for it was known in the time of the Romans; and it is not impossible that, as was the case with most sciences and scientific sports, it had its first beginning in Egypt. It would be foreign to our purpose to enter into the details of its history, farther than to mention that, though perhaps it may be reckoned a savage sport in itself, it is one the practice of which pre-supposes a very considerable degree of observation of the habits of animals, and of inference founded upon this observation—more

indeed than could be expected from any rude or barbarous nation; and, accordingly, we do not find that any uncivilised people ever employed falcons in the chase of birds, how much soever they may have abounded in their locality. Neither does it appear from any of the older writers that any attempt was made to reduce the flight of falcons to any thing like principle, until about fifty years ago.

Notwithstanding this, the division of birds of prey into noble and ignoble, and of such of them as were used in falconry into noble and ignoble hawks, is as completely founded upon structural difference, as if Cuvier himself had dissected and investigated them, muscle by muscle, and bone by bone, in order to determine in which way their active powers could be most successfully employed, and in what respects the one division differs from the others.

In classing those birds according to the relative powers of their wings and their modes of using them, the French writers, who have treated this subject with attention, distinguish them as *rowers* and *sailers*. The distinction between those two terms is exactly that between the noble and the ignoble hawks; only the kestrel, which was not used in falconry, rather disturbs the arrangement, by so far agreeing in wing with the kites, though its principal characters are those of the falcon.

In the rowing birds, the bones of the wing are remarkably perfect; and the bodies of the birds themselves are formed in such a manner as to offer the least forcible resistance to the wind, when the head of the bird is directed against it. The feathers are remarkable for the strength and elasticity of their shafts, and the closeness of their webs; so that while the feathers of the wings can strike against the air with great force, they are not laid hold of by it, and carried along by its current, as is the case with birds of more flocculent feather, and differently formed wing. The ten quills which are nearest the extremity of the wing, and which thus have the most rapid motion and produce the most powerful effect when the wing acts, are continuous, and have their barbs more firmly interlinked with each other than in any other birds. When the wing is raised, indeed, openings are made which admit its upward motion with comparatively little resistance, and the firm terminations of the barbs have an advantage in this respect; but when the wing descends, which of course is the stroke in flying, this most powerful part of it strikes as if it were the blade of an oar of the best construction. Those wings are narrow in proportion to their length, as compared with those of birds of inferior flight; they are also nearly flat on their under sides, and the under coverts and feathers are smooth and firm up almost to the junction with the body. In ascending flight, the birds do not carry the axis of the body horizontal, but have it at an angle, with the head considerably elevated, and the line of the body forming an angle with the wind, which of course the bird regulates according to the wind's velocity. A good paper kite seen in the air during a breeze, when the boy who manages it is running to windward, gives no bad idea of the position and even the motion and action of the rowing bird, or noble bird of prey, when it is rising against the wind; and in order to make the illustration almost perfect, we have only to consider that the gravitation and muscular action of the bird performs the same office as the string of the kite, and the muscular action of the boy in running along the ground. Such is the

structure of the wings in the rowing birds ; and we shall shortly mention this in the sailing ones, before we come to speak of the peculiar mode of action in each, and their different adaptations in the art of falconry.

In sailing birds generally, and in the ignoble birds of prey, the whole structure and texture of the wings are different. The bones are shorter, less firm in the joints, and less completely stretched in the act of flying. The quills of the extreme part of the wing are gradually shortened for about four from the longest feather, which is never the first or second, and is the fourth in the gos-hawk, which may be considered as the typical hawk, and was the one of the sailers that was the most esteemed in falconry. A wing of this structure acts much less powerfully upon the wind than one of the former. The tense bones of the former wing enable it to strike the air with its whole force ; but this one, in consequence of its being looser in the joints, and less extended, "gives" to the stroke, so that the one strikes like a firm, though somewhat elastic rod—the other like an apparatus to a certain extent jointed. The surfaces and terminations of the webs of the feathers also give themselves more up to the air than in the rowing birds. They are more loose and flocculent, not only in their clothing feathers and coverts, but in the quills beyond the coverts. This is apparent in their very appearance. The quills of the noble hawks are smooth and glossy to their very extremities, while those of the others have a dead colour, as if they were covered with some sort of fine powder, or very short nap, and the latter is the case. The covered part of the wing is also broader in proportion, and more loosely feathered ; and it is hollow not only in the direction of its length, in consequence of the imperfect stretch, but it is hollow also in the cross section. In short, it is a wing of which the wind can take hold, just as it does of the belly of a sail. Such a wing is of course ill adapted either for rising or for progressive motion against the wind, but it is equally well adapted for going with the wind, and also for all sorts of short action in the air, in places where the wing of a falcon would not have scope for its more powerful action. Such a wing, and the general plumage of the bird answers to it, upon the principle of harmony which runs through all nature's productions, is calculated for leaning on the air, or hovering, as it is usually called, for a far greater length of time, and in finer style, than could be done by the rowing bird, no part of which is adapted for taking a hold on the air. Wings of this description are also, generally speaking, shorter than those of the other, and this adds further to the accommodation of the sailing bird in those situations for which it is best fitted. Such are the general characters and distinctions of the wings in the two sorts of birds used in falconry.

There is also a very considerable difference in the structure of the feet. In the rowers, or noble hawks, the tarsi are always short, and, generally speaking, they are short in proportion to the power of the bird. The toes, also, have great power of motion, and the claws are very sharp. In the short-winged birds the tarsi are always longer, often pretty long in proportion to the size of the bird ; and though the toes are perhaps not, upon the whole, less powerful, they are not fitted for such rapid and immediate action as those of the other division. There are some other peculiarities, such as more looseness in the general

form of the body in the short-winged bird, but those of the wings and feet, as above mentioned, are the most important ; and as the whole structure of the bird is in accordance, those minor particulars may easily be inferred from what has been said.

Now, if we consider either the localities of the two divisions, or the manner in which they obtain their prey, we shall perceive how beautifully each is adapted to its purpose, and how much both would be at a loss if they were made to change places. The falcons are birds of the open grounds, of the rocky mountain, and the wide moor, and their prey, in so far as it consists of birds, is killed by the stroke delivered in the open air, and not clutched with the talons ; for, when a falcon hunts in good style, she strikes her prey to the ground, and descends after it. The hawks, on the other hand, are more birds of wooded places, where they have many turnings to make, and do not require the straight-lined rush of the falcons. In catching their prey, they clutch it with the talons rather than strike at it, and the length of the tarsus seems to assist them in this process. The eagle, which is a broad-winged bird, and the kite, which is a bird with wings of rather a mixed character, form exceptions to this, as the eagle is invariably, and the kite generally, found in open places, though the latter frequents the neighbourhood of woods. Both of these, however, prey upon the ground, and are clutching birds rather than striking ones ; but as neither of them was trained for falconry, they do not require a further description in the present place.

There is something worthy of remark in the different manner in which the falcons and the hawks attack their prey. The falcon, of whatever species it may be, always aims its blow at the most vulnerable part of its prey, or that which shall most instantly occasion death ; and in birds this vulnerable spot is the nape, immediately at the articulation of the skull with the vertebral column, so that a stroke given here, of the force with which even the lightest of the falcons rushes upon its prey, is sufficient to fracture the skull, or dislocate the neck. So accurately is this done, that the merlin, light as it is, will strike dead to the earth a bird heavier than itself, with so much rapidity as that it can hardly be perceived ; for it is no sooner in contact with the living bird than the dead one separates from it. Hawks, and sailing birds of prey generally, are not so particular as to the place at which they aim their stroke ; their object is rather to clutch their prey, and hold it by main strength, until they have strangled, or otherwise pressed and torn it to death. We cannot help noticing here a remarkable coincidence between different divisions of predatory birds and predatory mammalia. All the clutching and crushing mammalia, which catch their prey by lying in wait, or by other stratagems, seize it indiscriminately by any part, and either run it down, under the double effect of their weight and the torture which they give by their teeth and claws, or they crush and rend it. But the coursing mammalia, which run down their prey in open chase, invariably seize upon some vital part, as is observed in those dogs which are in the wild state, and in ill-bred domestic dogs, which so far return to their wild habits and savage propensities, as to prowl about at night and bite sheep. A practised canine thief of this description will sometimes, in the course of a single night, kill and bleed more than a dozen sheep without in the least tearing or breaking the carcasses ;

whereas, if any animal is seized and killed by one of the feline or clutching race, no matter for the species, it will invariably be found to be mangled. Those coincidences between animals of different classes, in respect of their modes of action, are among the most interesting points in natural history, because they give us two lessons of the utmost value—the one for our instruction in a scientific, and the other in a moral point of view. In the first place, they clearly demonstrate, that if we once properly get hold of a principle, and follow it out into its details, so as to see everything respecting organisation, locality, and habits, we can proceed by analogy from these, and greatly abridge the labour of acquiring a knowledge of other parts of the system. In the second place, they demonstrate, that the law of nature is one, that purpose and adaptation run uniformly through the whole creation, and that therefore the Author and Governor is one.

It is not very easy to give, in few words, such a generalisation of the action of these birds as can be considered popular, and yet it is so much connected with the action of animals generally, and with that of feathered animals in particular, that every body should understand something about it. It may, in general, be said that the falcons, and birds which are winged and feathered like the falcons, are capable of making the greatest possible use of the air, while the air has the least possible effect upon them; and that the hawks, and birds winged and feathered like the hawks, are always in so far at the disposal of the wind, though less so than the majority of those birds on which they feed, otherwise there would be no food for the hawks, unless what they could get by stratagem and lying in wait, as is done by the greater majority of the owls.

As the air has comparatively little hold upon either the wings or the feathers of the falcons, they can keep their intended course with much less labour and more certainty than those birds whose wings and feathers take hold of the wind. This, however, prevents them from being able to wheel and double so quickly or within so small a compass as the others, and therefore they can be effective only in situations where they have scope for their wings. In the free expanse of the air, however, they have advantages which no other birds possess, and thus the wing of the falcon may, in its proper element, be said to triumph over every other wing. No bird that rises down the wind can gain much additional height without being carried to a very considerable distance in the direction in which the wind blows; and no bird upon whose feathers, whether those of the wings or the body, the wind takes a powerful hold, can fly across the wind without making a good deal of leeway, and being thrown out of any aim which it may have taken, while the hold which the peculiar texture of its feathers takes on the matter of the atmosphere must tend very much to retard its motion even when the air is still. But all these circumstances, disadvantageous as they are in forward flight in the free air, are of use to the short-winged birds in the way in which they in general act. Such of them as look out for ground prey can, by this means, float and hover till they have scoured the whole of an extensive horizon; while those which prey in the woods and among bushes, can turn and glide, so as to come upon their prey with greater ease. They are also muffled, as it were, by the

formation of the margins and surfaces of their feathers, and thus they can range in comparative silence those places where the sound of the firm wings of the falcon would give instant warning of her approach. Thus, in the free air over the wild, nothing which she marks out as her prey can escape the bold pursuit of the falcon, though there are many birds that in such places can defy the hawk. On the other hand, when the range is interrupted, or the bird flies low and doubles, the hawk can keep sight of it and wear it out, when all the strength, force, and rush of the falcon would be quite unavailing.

In illustration of this, we may mention an instance of the superiority of falconry over hawking in the open plains, which was observed in a remote district of the Scotch Highlands a few years ago by a friend of the writer of this article. It was early in the season, and long before shooting on the moors commences, that our friend, in company with a resident veteran of the hill, who knew the habits of every creature that appeared on it, had wandered nearly as far as the water-shed in one of those wide and half-boggy passes, which are so much resorted to by the semi-aquatic birds which breed in the inland wilds. When they had fatigued themselves with the heavy footing through heather, and moss, and long grass, they sat down upon a “a rest-and-be-thankful” stone, to survey the glen, of which the height that they had now gained gave them the command, they observed a large light-coloured bird of prey in pursuit of a lapwing, which was doubling about in all the ways that its very hollow wing admits of; and as the wind was from the hill, their progress was, upon the whole, down the glen before it. The falcon, from its apparent size and the whiteness of its colour, was either a full-grown jer, or one of the larger variety of Iceland (if that is a variety); but still, what with the doubling, what with the advantage of the wind on the concave wings of the prey, the falcon lost rather than gained, and had it persevered in this kind of chase, the lapwing would have worn it out. After some time spent in this hopeless pursuit, the falcon turned round to windward, in the very opposite direction to that in which chase had been given. Our informant expressed his surprise that a bird of such apparent power should thus abandon her prey. “She will return,” said his companion, “or else she is not true either to her colour or her course; *that* is not the way in which falcons abandon their game.” They watched the course of the falcon, which had risen at a comparatively small angle with the perpendicular, till she seemed no bigger than a lark; and the lapwing, alarmed by the pursuit, was still wheeling about in the air at no very great distance. At last the falcon halted and turned, and her wings began to shiver in the air. “Mark now,” said the mountaineer, “whether she has or has not abandoned her game.” In an instant, she shot downwards with the rush of an arrow; the lapwing gave one shrilly wail, and appeared to lose all command of its wings; and in less than a minute they heard the sound of the stroke, and the lapwing fell to the earth, from which it again rebounded by the violence of the fall. They of course left the falcon to enjoy in peace that feast in the obtaining of which she had shown so much science.

No birds are thrown into greater consternation by the flying of a falcon over them than magpies; and although this kind of sport makes nothing for the “pot,” it shows in what dread the falcon is held.

The best way is to watch for a time when the magpies hold one of those councils which are not unfrequent among these curious birds, and then to let fly the falcon. The council is generally held at no great distance from some cover, such as a broom or furze-bush, and the magpies have generally all their eyes about them, so that they espy the falcon as soon as she is in the air. Then it is "hurry-skurry" for the cover, into which they creep, and lie so close that the whole posse may be taken with the hand. If there is no cover which they can reach, they squat flat and motionless on the ground, and may be picked up in the same manner. We know not how the jer might come on in the event of being flown at the raven; but we once saw an instance of the common falcon, in which it appeared to be a drawn battle between the two, and as the companion raven was approaching, the falcon, but for human aid, would have been the victim.

To observe the action of these birds, whether the flight be low or high, is a very easy matter; and after the principles of mechanics, and the structure of the birds are once fully understood, it is by no means difficult to explain the *rationale* of their action, and to show how admirably each is adapted to the place which it holds, and the functions which it performs in animated nature. But after this is done the grand difficulty remains behind, namely, how the powers of these, apparently the wildest and most wayward of all living creatures, should be brought into complete subjection to man, and made as obedient to his command, as if they were endowed with reason. This, however, has been done, and done so completely, and under such different circumstances of species and of age in the birds, as to leave no doubt that, by due attention and proper training, man might press every power and every faculty of the animal kingdom into his service,—that, for instance, he might make the porpoise, the seal, and the pike catch fish for him as readily as the hound catches hares, or the falcon strikes down pigeons. Nor is it at all unlikely that, amid the vast improvement which has of late years taken place in the mechanical use of dead matter or the application of its chemical powers, the capabilities of life have been too much neglected; for we may rest assured that the use to man of every thing in creation, if he could once find it out and know how to apply it, is in exact proportion to its energy in the wild state; and this is the chief reason why the training (for it cannot be called taming) of these birds of prey is so worthy of attention.

For the purpose of falconry, hawks were not in general bred in a state of captivity, and indeed the falconers who had charge of them used many arts to prevent them from breeding. There were three ways of obtaining them, or rather they were obtained at three different ages. The young birds when they could be found in that state were taken from the nest, while they were yet covered with down instead of feathers. In this state they were, in the language of falconry, called *simples*, and though they were longer in being ready for use than the more advanced ones, their education, from being begun so early, was much more easy. Another age at which they were perhaps more easily procured, was that at which they were so far fledged as to be able to quit the nest, but not so much so as to be capable of flight. In this state they were termed *branchers*, which term was in all probability derived from those species which

build their nests in trees. These were a little sooner ready for action than the simples; but their education was considerably more difficult, as they had acquired more of their natural character in the wild state before their education began. The third means of obtaining them was, catching the wild birds in nets by means of various stratagems, which had to be varied according to the species. The birds obtained in this way were of course much sooner fit for sport than the younger ones; but the training of them was a matter of much more difficulty. Those birds which had acquired their natural character in whole or in part, before they came into the hands of the trainers, were called *haggards*, and the same name was bestowed upon refractory hawks and falcons, which were sometimes in the habit of breaking away from the game for which they were trained, or of flying off with the game and not returning to the falconer. Birds which had this habit were held in very low estimation; as may be judged of by a very beautiful, though metaphorical allusion in Shakspeare's tragedy of Othello. Iago had just worked up the Moor to the requisite pitch of jealousy, and left him to the agony of his feelings; and in his frantic soliloquy he is made to give utterance to the following words among others—

If I do prove her *haggard*,
Though that her jesses were my dear heart-strings;
I'd whistle her off, and let her down the wind,
To prey at fortune.

This passage, short as it is, contains a pretty ample epitome of the characters of falcons, though the poet has a double meaning in the word "haggard" in allusion to human frailty. If she acted as a rebellious falcon, untrue to her training and trust, then she was to be sent, after the manner of the ignoble hawks, to provide for herself as she best could.

It would be too long to point out all the steps in the education of hawks; but at whatever age they were taken, the first thing to be done was to attach small bells to their feet, so as to accustom them to noise every time they moved. If simples, they were provided with eyries, which were shutters lined with straw, placed at a little elevation for the birds of high flight, but on the ground for the low-flighted ones; or, if the nest be naturally in such situations, the rock breeders were placed on the top of a wall or heap of stones, and those which breed in trees had a nest for them placed in a tree at no great height. Near the openings there were boards placed, on which they were made to perform their first exercises, and on which also they were fed, in order to attach them to the place in which they were exercised. Their food consisted of beef or mutton, but especially the latter, which is indeed the best food for them at all ages; and must be freed of all the cartilage and fat, and cut into slender and not too long shreds, but the more recent it is and the more blood that there is in it, they eat it with a greater relish. As soon as the low-flighted hawks were able to descend from the board and get up again, their food was placed on the ground.

When the unfledged young are taken from the nest, this nursery treatment is continued for about six weeks, and if they have been properly fed and attended to, they are by this time able to catch such small birds as come within their reach, which shows at how early an age birds of this description begin to catch prey for themselves. Up to this period the birds are allowed the full enjoyment of their liberty, both because they are too young for entering upon

their formal training, and because they need to acquire some strength; but when they are able to catch small birds, the *jesses* or wops of leather are put round the tarsi, and a ring and cord attached, by which they are confined during great part of the training, and the jesses remain, in order that they may be confined by these whenever it is necessary, as confinement by the feet is the surest way to keep them from injuring themselves or anything else. The branchers are much sooner ready for putting in training than the unfledged young, but the training is proportionally difficult, because the others have been accustomed to noise, and the sight of men and dogs, during their nursery treatment.

Falconers used to prefer nestlings when they could be obtained, because their training was much more sure as well as easy, and next to these they preferred branchers. When none of these could be obtained, then the object was to capture full-grown birds. The smaller ones were obtained in common bird-nets, by descending on the call birds; and the goshawk, and even the falcon were sometimes caught, but much more rarely, though the latter was frequently enticed by a pigeon and a tame falcon. Owls were also made use of for the purpose of enticing the falcons and the larger hawks into the net. The jerfalcon, from its superior power and wildness, was much more difficult to be taken in snares than any of the others; but then the jerfalcon was so much more effective against the larger game, and brought so much higher a price, that even she was taken in her fastnesses of the north, so that at one time there was a regular export of jerfaleons both from Iceland and from Norway.

In the case, both of the highfliers and the low, the difficulty of the training was pretty nearly in proportion to the value of the bird after it was trained, though the goshawk rather formed an exception to this, being much more docile and easily managed than even the sparrow hawk. Among the true falcons, the merlin was the most manageable, required less training than any of the rest, and came more readily at the call, neither did it so soon go out of training when not properly exercised. On this account, and also from the elegance of its form, and the certainty of its stroke, the merlin was a great favourite. The hobby, on the other hand, was a stubborn little fellow, and required nearly as much trouble to *reclaim him*, that is to make him return at the call of the falconer, as any of the larger ones, excepting, perhaps, the jerfalcon.

When mature birds of the stubborn species had to be trained, the first object was to reduce them low enough; and some nicety was required in order to subdue the bird sufficiently, without at the same time injuring its health. Low diet was one of the means resorted to, the food being reduced to half the allowance of a trained falcon, and its stimulating quality diminished by steeping it in water. Aperient medicines were also administered for the purpose of reducing the tone of the internal part of the system, and cold water was applied in order to bring down the tone of the muscular system. With the jerfalcon this training had generally to be continued for about six weeks before the bird was sufficiently subdued, he being kept blind-folded all this time by a hood. In order to ascertain whether the bird was subdued or not, they touched his head in various places, rubbing him at the same time with a pigeon's wing in a recent

state, and fresh with the smell of that bird and its blood. If the bird bore this teasing and temptation without excitement, and moved his head obedient to the hand, he was considered fit for occasional exposure to the light; but several weeks more were necessary in order to make sure of the bird's obedience. When this was achieved, they then taught the falcon to know and fly at the kind of game for which it was trained, by dressing up lures or imitations of the game, and placing food in the blood upon them. This was accompanied by teaching the bird to come back to the arm or hand of the falconer, which was accomplished by jerking away the food from the wire, and then giving a little food on the return to the hand. It is inconceivable how much care and trouble were required in order to reclaim a mature female jerfalcon in this way, for it was almost as much as, in the modern system of military tactics, would discipline a whole regiment for the field. Even after all this trouble had been taken, the jerfalcon required the most watchful attention, because it always retained a certain degree of irritability, and therefore could be turned to proper account only by a falconer who thoroughly understood his disposition. For these reasons, even at the time when the feudal system was at its height, and the many were, throughout Europe, the slaves of the few, and made to minister to their caprices, it was not every owner of a baronial castle who could afford to fly jerfalcon, and a good one was a becoming present for an emperor. Matters are somewhat changed in this respect now-a-days, and giraffes and elephants are almost the only animals deemed worthy of royal presentation.

The peregrine falcon was reclaimed with much less labour than this, and in much shorter time; and as the peregrine could be obtained in many countries where the jer could not, and farther, as she was much more docile and obedient to the falconer, and by no means liable to lose her temper, she was the falcon in most general use for high flight; nor are we sure that, for all her great power and her high price, the jer was ever complimented with the name of a "*gentle falcon*;" at all events, if she had the name she had none of the reality. In point of training, the hobby stood nearly in the same relation to the merlin that the jerfalcon did to the peregrine, and as its powers are not greater than those of the merlin, it was not held in so much esteem.

The training of low-flighted hawks was a simple matter compared with that of falcons, and scarcely required more days in the hands of a skilful reclainer than the jerfalcon required weeks. The goshawk was the favourite, both on account of its docility and its woodland habits, though probably the sparrowhawk is a bird of more spirit.

In all cases of training, the object was to have the bird in such spirit as that it would fly at its proper game or quarry the instant that it was unhooded, and return again to the arm of the falconer whether it struck or missed its prey. In addition to this, there were many qualities of a good hawk dependent on the animal itself as distinguished from others of its species, but it does not appear that the labours of the reclainer had much to do in the production of these. The great use which was made of cold water in training those birds, and also in reducing them when excited, or keeping them low and even in health at those times of the year when they were not used in

sport, is worth attending to, the more so that the same application very speedily takes down the heat of the temper of other animals. When dogs fight, there are no means of putting an end to their hostilities so speedily and so certainly as by sousing them each with cold water; and it is very probable that, in many other cases of animal irritation or stubbornness, the same application would be equally effective. Indeed, if in all cases in which animals naturally ferocious have been brought into subjection and obedience, the different steps by which this result has been arrived at had been carefully noted and duly arranged, we should have been in possession of a body of highly valuable practical information upon a subject of which we are in a great measure ignorant. Nor is there any doubt that if this could be fully and judiciously made a matter of science, very many of those creatures which we now pass by as useless, and persecute as noxious, might long ere now have been useful and obedient servants, and that whether they belong to one or to another of those classes which have sufficient size and strength for taking a part in labour. It is principally with a view to recommend this, that we have written the present article, because the subject is one upon which we must have a great deal of practice before we can have any theory.

FASCIOLARIA (Brugnières; **MUREX**, Linnæus). This genus of molluscs was classed by Linnæus with the *Murices*, and the French naturalist Brugnières appears to have been the first to point out the propriety of a separation; but he was not sufficiently accurate in his observations, and confounded them with the genus *Fusus*, also another of his own separations from the *Murices*. The *Fasciolaria* may at once be distinguished from the *Murices*, by never having any varices, though it has a canal at the base; from the *Fusus*, they differ by having plaits on the columella. This circumstance brings them nearer to the *G. turbinella*, but in that the position of the plaits is *transverse*, while the shells of the present genus are *spirally* oblique. The form of these shells is fusiform, the spire of a moderate length, the aperture oval, lengthened, nearly symmetrical, terminated by a rather long straight tube, the external margin sharp, and the columella furnished with two or three oblique plaits; the whorls of some species are nodulous, it has an epidermis, and possesses a horny operculum. The name of the genus is derived from *fasciola*, which word describes its characteristic distinction. Modern naturalists form a natural association of the species, as follows:—those whose shape is fusiform, but not tuberculated; secondly, those of the same form but with tubercles; and lastly, such as are like the last division, but with the spires turriculated. Eight species are described by Lamarck, one only being found in the Mediterranean, the others are principally from the Indian Seas; about the same number of fossil species are known.

FERONIA (Latreille). An extensive genus of coleopterous insects, belonging to the section *Pentamera* and family *Carabidæ*, forming the type of one of the divisions of the sub-family **HARPALIDES**, which see.

FERRARIA (Linnæus). A genus of bulbous plants introduced into Europe from the Cape of Good Hope. Class and order *Monadelphia Triandria*, and natural order *Irideæ*. Generic character: flowers in a spathe: corolla in six oblong undulated

segments, the outer ones broadest; stamens, filaments joined to the tube; anthers rather egg-shaped, double, style filiform; stigmas three to six, pencil formed; capsule below three-celled. The *Ferrarias* bear beautiful flowers, and thrive in sandy loam; like *Ixias*, they should be kept in a frame and perfectly dry when not growing, but regularly watered as soon as they present their leaves.

FERULA (Linnæus). This is the giant fennel of botanists, and consists chiefly of large coarse-looking herbs, found over all the northern parts of Asia and Europe. The genus belongs to the fifth class of sexual botany, and to the natural order *Umbelliferæ*. Two of the species, viz. *Persica* and *assafœtida*, yield the medicinal gum, known by the latter name. The plants are cultivated in Persia, whence the drug is exported to all other parts of the world.

FESTUCA (Linnæus). A genus of grass found in almost every quarter of the globe, and one of the most useful in pastures, particularly those for sheep. Twelve species are agricultural; and the pure seeds of most of them may be purchased at the shops of agricultural seedsmen.

FICARIA (Dillwyn), is a common weed found in damp woods. It is called pillwort, from the shape of its little bulbs, which lie on the surface of the ground, appearing like scattered grains of wheat. It belongs to the natural order *Ranunculaceæ*, and was considered a *ranunculus* by Linnæus.

FICOIDEÆ. This natural order contains all those plants known by the name of fig-mary-golds, or mid-day flowers, so denominated from their usual time of flowering. They are herbaceous plants or under shrubs, with opposite or alternate fleshy, simple leaves; of very curious and often grotesque forms, and destitute of stipules. The inflorescence is for the most part terminal, seldom axillary, and the flowers are regular and united. The sepals are definite, usually three in number, but varying from four to eight, more or less connate at the base, and either free or adherent to the germen. The



Ficoideæ.

petals mostly indefinite and often connate, sometimes five alternate with the sepals, and occasionally abortive when the inner part of the calyx is coloured. The stamens are indefinite and seated round the germen; filaments free; anthers oblong, incumbent,

two-celled, opening lengthwise. The ovary is either free or adhering to the calyx, and consists of as many carpels as there are sepals. The styles are distinct and short, and the stigmata simple.

The fruit is a many-celled capsule, either free or encompassed by the fleshy calyx. When drupaceous, indehiscent: when dry, opening in a star-like manner from the apex; seeds indefinite, seldom definite, and very seldom solitary by abortion.

The flowers are generally beautiful, and the plants are great favourites with many cultivators. Upwards of 400 species are already known. The *M. crystallinum* is the common ice-plant, and *M. umbellatum* is extremely showy. They are all innocuous; and the succulent leaves of *M. edule*, *sesuvium*, *Portulacastrum*, *Tetragonia expansa*, &c. make excellent substitutes for summer spinach; and are used as such in South Africa. The *M. crystallinum* is called in Spain *Barilla moradera*, and is cultivated to a great extent for the purpose of procuring alkali for the glass-works; and in one year the exports of its ashes from the Canary Islands, amounted to 600,000 francs. *M. nudiflorum* grows wild in Egypt, and is there burned for the same purpose.

FICUS (Linnæus). A very extensive genus of lofty trees and shrubs, chiefly tropical. Linnæan class and order *Polygamia Diœcia*, and natural order *Urticææ*. Generic character: receptacle fleshy, closed, but permiable at top, androgynous; florets on footstalks, males three-parted; stamens three, females four, or eight-parted; styles laterally divided; seeds contained in the pulp of the receptacle. Only one (*F. carica*) of the many species yield eatable fruit, and which is the cultivated fig of our gardens. In the south of Europe figs are one of their most esteemed and valuable fruits, not only from their forming an article of diet in the season, but from their being an important article for exportation to other countries.

The fig-tree is remarkable for yielding, in its native country, two crops of ripe fruit in the course of twelve months. The young fruit which make their appearance in the autumn of one year, ripen in the beginning of summer in the next; and the fruit which show themselves in the spring, ripen in the following autumn. In this country the spring-produced fruit rarely or never ripen in the open air; but the autumn fruit, if they escape the frosts of winter, ripen perfectly, as well on standards as on walls.

No tree is more easily increased than the common fig; suckers which the tree produces in plenty, make good trees; it also strikes root readily from either layers or cuttings. Planted against walls, they are usually trained with branches diverging from the root like a fan; but they may be trained in any form. Standards in the open ground are trained in the round bush form.

The best soil for figs is a strongish hazel loam on a dry bottom, but they thrive in any good garden soil.

Much depends on pruning; the young shoots produced in the spring do not ripen fruit, but if these shoots be stopped by breaking off the point as soon as they are from four to six inches long, they will produce other shoots which will bear plentifully, and ripen fruit in the autumn of the next year. So that keeping the tree free from old branches and stopping the spring shoots every year, about midsummer, will keep a constant supply of bearing wood to be depended on. Large fig-trees on walls managed in this manner, are well worth defending from frost by woollen net-

ting, or some other temporary curtain, to be let down or put up when necessary. All the fruit produced on the spring shoots, and which never ripen, should be pulled off the tree in September, causing very frequently other young fruit to come forth on one or both sides of the place where the first grew. This second birth are sure to ripen in the following summer.

When hothouses are built for the cultivation of the fig in this country they are brought to very great perfection, not only as to quality and quantity at the usual and natural seasons, but for the advantage of having this fine fruit in every month of the year. And this resulted only from a little extra care in pruning, and the application of fire heat at the proper times when required. The native climate of the tree is imitated and maintained, so that its natural tendency to produce double crops is favoured and assisted; and indeed, if the tree be well nourished at the root, and kept in a high temperature, it proves an everlasting bearer. No fruit tree answers better in pots or tubs than the fig; and where there is a dozen or two of potted plants, and a hothouse or pit always in work, the manager may have ripe fruit at any time.

There are fourteen or more varieties cultivated at present in our gardens; a few of the best are as follow:—

Brown or chestnut-coloured Isehia.	Large Genoa.
Black Genoa.	Black Isehia.
Small white early.	Brown Italian.
Black Italian.	Brunswick.

FIDDLE-WOOD is the *Citharoxylum quadrangulare* of Linnæus, a genus of ornamental timber trees; chiefly natives of the West Indies, and belonging to the natural order *Verbenacææ*. These stove plants are easily propagated by cuttings struck in sand under a glass.

FIELD CRICKET, the *Acheta campestris*. See **CRICKET**.

FIG TREE. See **FIGS**.

FILBERT is the *Corylus avellana* of Linnæus. The name filbert is only applied to the improved varieties of the common hazel nut, of which there are eight or nine in cultivation. A few filbert trees are seen in every garden, but in the county of Kent fields of many acres are planted with them; and to the owners yield remunerating crops. Filbert trees are propagated by grafting it on the common hazel, or, what is better, by layers. When these are rooted, they are lined or bedded out in the nursery, and there trained up with one upright stem pruned clear of branches. When planted in their final stations, the stem is cut down to eighteen inches from the ground. This height will admit of a clear stem of twelve inches below, and which part must at first and ever afterward be kept free from shoots, as well as suckers from the root, which last the tree is very apt to produce. The deprivation of shoots and suckers will cause the buds left at the top to shoot with greater vigour. If eight strong shoots be produced in the first summer, they must be carefully preserved, as that number is required to form the head; but if less than this number come forth, then two or three of the strongest (or the whole if necessary) must be shortened back to half their length at the next pruning, in order to obtain the requisite number.

The full number being obtained, they are carefully preserved and trained outwards and upwards; at first nearly horizontal, but curving gradually upwards.

The easiest mode of doing this is by using a hoop of proper size placed within the shoots, and to which the latter are tied in star-like order, and at equal twelve-inch distances. Such a laterally curving position may be much assisted and caused by the pruner always cutting at an outside bud, which naturally grows first outward and then upward, and continued to the height of six feet, but never higher; and the middle of the tree is, in the mean time, kept free from shoots and branches, so that a well-trained head becomes at last like a large bowl or basin.

The subsequent management of the trees, both while gaining the desired form and after having gained it, consists in preserving all the short spurs produced on the branches, and shortening the small lateral shoots, which every year rise from the same. The management of these laterals is of great importance. If they exceed the length of six inches, they may be cut back to a few buds; but if less, they should be preserved entire, as their points are generally fruitful. The special object of the pruner is to have the branches thickly beset with fruitful spurs, and which are only reduced in length, when, after a few years' growth, they become too distant from the branch, when they are pruned back to a healthy spur at their base. If any part of a branch become accidentally naked, a strong shoot from the bottom may be led up, and managed so as to fill the vacancy.

When filbert trees are thus managed, and have arrived at their full volume in width and height, they may be kept in the same state for many years—say twenty or thirty—by the knife only, and with the requisite skill in using it. When the fruit are intended for long keeping, they should remain on the tree till thoroughly ripe, which is indicated by the rich brown colour of the shell. They require to be laid on a dry floor for a few days, and afterwards stored in jars of dry sand, where they, the kernels, will keep sound for a long time.

FILICES are the first order of the class *Foliaceæ*, in the second grand division *Cellulares*. This order includes all the ferns, of which there are fifty-three genera, and three hundred and eighty species. The



a. b. c. d. Part of a frond and magnified capsules of ferns.

ferns of this, and other temperate regions, are comparatively humble plants, their true stems generally creeping on the surface of the earth, or subterranean; but in the West Indies, and other hot insular situations, arboreous species are found, the stems of which rise out of the earth, and elevate their crowns of fronds to the height of thirty or forty feet, or even more. In these noble examples of the class, the true structure of the stem, and affinities of the plants in general with the palms, is much more obvious, even to the common observer, than in the suffruticose and herbaceous brakes that are now indigenous to these northern latitudes. The fronds or leaves are usually pinnatifid, and more or less compound; sometimes nearly simple and entire, with reticulated veins. The capsules

are minute, one-celled, brown, membranous, and surrounded by a thick articulated elastic ring, irregularly bursting, and either clustered on the lower surface of the frond, or compound in spikes. Their expansion is circinate, and some increase themselves by bulbs.



a. b. c. Frond and fructification of ferns.

The old botanists denied that ferns had seeds; but it is now proved beyond all doubt, that the fine dust shed by the fronds are really seeds.

Ferns delight in a humid soil, and they often grow parasitically upon trees. The medicinal virtues of some are highly astringent, others anthelmintic, or purgative; some are said to be pectoral, and others are valued for their corroborant qualities. The young leaves and roots of some are used as food; beer is brewed from the roots of others; and the fronds of *Aspidium fragrans* has been used as tea.

FIMBRIA. A genus of shells constituted by Megerle, but now classed with the genus *Lucina*, as being properly no other than one of its species. Cuvier, however, called it *Corbula*, but a more accurate examination of the species appears to confirm the propriety of referring these molluscs to the genus *Lucina*.

FINCH. (See FRINGILLIDÆ.)

FIORIN is the *Agrostes stolonifera* of Linnæus, a British grass, of which much noise was made some years ago by a Dr. Richardson of Ireland, who maintained that it was more valuable for green winter fodder than any other: that it was indestructible by rain or snow, and contained great fattening qualities. It has been extensively tried in other countries, but has not maintained the character first attributed to it as a winter fodder.

FIR, is the English name of the trees included in the genus *Abies* of Salusbury. The silver and spruce firs are the most common examples of this tribe of forest trees. Linnæus ranked them in his twenty-first class *Monœcia*, and tenth order *Monadelpia*, and they are among the most magnificent plants of the order *Coniferæ*.

The firs are almost all remarkable for the regularity of their growth, tapering form, and great altitude of their boles. Their timber is also excellent, and almost solely used in the construction of houses; being easily convertible, and withal durable, in consequence of the great quantity of resin it contains.

The hemlock spruce is one of the commonest trees of North America, and on the west coast of the middle parts of that continent, some of the firs grow to an amazing size and height.

All the varieties are raised from seed, and, after being transplanted two or three times in the nursery, are then fit to be planted out for good. For further particulars of this interesting genus, see ABIES and CONIFERÆ.

FIRE-FLY. A name indefinitely bestowed upon any winged luminous insect. The *Elater noctilucus* (see ELATERIDÆ); the *Fulgoræ candelariæ* and *lanternariæ* (see FULGORA), and sometimes also the winged glow-worms (LAMPYRIDÆ, which see), being alike

described in popular works under this name, although some of them are beetles.

FISH. *Ichthos* is the Greek name for a fish, and from this, that branch of natural history which treats of fishes is called *Ichthyology*, which means "the voice of fishes," or the account which they can give of themselves, not in words, of course, for fishes are remarkable for their silence, but in such facts and relations as human observation can collect concerning them. Fishes form the fourth and last division of vertebrated animals in Cuvier's structural arrangement of the animal kingdom; and, from the length of time, and close and scrutinising attention which he bestowed upon this class of animals, his arrangement of them must be considered as perfect a model of a natural system as the whole mass of acquired knowledge, in the hands of probably the ablest and the most candid generaliser that ever devoted his talents to the promotion of the knowledge of nature, could afford; and it is well for the world that there was a Cuvier to give a scientific form to this department of natural history, and give to the makers of local discoveries a foundation upon which they can build with safety. The advantage of this in the class of fishes, above all other classes in the animal kingdom, must become apparent to any one who reflects for a moment on the field which the fishes occupy, and the powers with which they are endowed of increasing their numbers.

We need hardly mention, that, with few and casual exceptions, such as the march of an eel for a few yards over the meadow, or the passage of a flying fish for a few yards through the air, the fishes are all inhabitants of the waters; and though it is possible that the number of them in the fresh waters may not be much less than that of the land mammalia, or the land birds, yet this number, vast as it is, sinks into nothing when we turn our attention to the sea.

Any one who is in the least conversant with the elements of descriptive geography must be aware that the extent of the sea is much greater in mere surface than that of the land: that, if we reckon the whole surface of the globe, in round numbers, at two hundred millions of square miles, which is not very wide of the truth, the land occupies only about sixty millions of these, while the sea extends over one hundred and forty millions, or double the extent of the land, and a third over. This, however, is not all, nor nearly all, when we come to consider the capabilities of the two for being the abodes of life. In the first place, the land contains many portions, and those of considerable extent, which are permanently barren, and incapable of furnishing food for a single living creature, while many other parts of it are subject to periodical barrenness. The sea, on the other hand, contains no barren spot, for its waters are everywhere nearly the same both in composition and in degree of temperature; and thus, taking surface for surface, and considering the animals which are adapted for the two great component parts, it is the land which is comparatively the desert, while "the waste of waters," as it is sometimes called, is fertility all over. But, in the second place, even this is taking a view of the subject too favourable for the land, and therefore unjust to the productive powers of the sea. It is the surface of the land only which yields food for its inhabitants, or, at most, the trees and plants which grow out of it; and as there certainly is not a tree or plant

upon the face of the land answering to every hundred square feet, that is, to every square of ten feet, and rising to the height of one hundred feet, we may safely say that one foot of habitable depth is an ample allowance for the land. It is not, in fact, the tenth, or even the hundredth part of this; but we shall allow it to be one foot, and then let us proceed to compare its habitable and supporting extent with the habitable and supporting extent of the sea. To gauge the sea is out of the question, for it is rather a difficult task to gauge a mill-pond, if it be anything irregular in shape and depth; but those who have paid the most attention to such analogies as are attainable upon a subject so vastly great, have assigned to the whole of the sea an average depth of between four and five miles. Let us, however, take it at the depth at which fish have actually been caught, namely, fifty fathoms, or six hundred feet (and we are not warranted in saying that this is the lowest limit), and we have every mile of sea equal to six hundred miles of land, or the whole pasture of the fishes to that of the land animals as fourteen hundred to one. It is true, that the fishes which are taken at these great depths are peculiar—that they have great eyes like the owls and other nocturnal feeders among land animals, indicating a deficiency of light in their profound abode; but we know not the limit, even in the depth of the ocean, beyond which we are warranted in saying that there can be no living creature.

Such is the pasture which the Author of Nature has prepared for the fishes; and, in order that they may increase and multiply, so as to replenish this ample pasture, he has endowed them with reproductive powers of the most extraordinary character. Some of the land animals are no doubt very prolific, but the races which are so are very minute in their size, and the duration of their lives is brief, they being seasonal only on most parts of the land, and in most situations. Some of the most productive inhabitants of the sea are, on the other hand, of large dimensions, and, instead of being merely seasonal, as is the case with land animals of very numerous progeny, they not only last for years, but, as we shall show by and by, they do not contain in their structure that element of death which ultimately brings the most long-lived inhabitants of the land to mingle with its dust. As an instance, we may mention the common cod-fish, which contributes so largely and so wholesomely to the food of many nations, and which, notwithstanding the great number of hands employed in its capture, never appears one jot less plentiful. A single cod-fish produces, at one birth, as many as between three millions and four millions of young; while the common flounder produces not much less than a million and a half. These statements are well calculated to stagger the belief of any one who has not attended to the subject; but they are the results of actual observation in counting the number of eggs in the roe, by those who could have no earthly object in the matter other than the discovery of the truth. We have thrown out these hints in order to show how well worthy the finny tribes are of our most careful observation and study; and having done so, we shall proceed to give a brief general view of the class. In order to render this view as intelligible, and, at the same time, as complete as the narrow limits within which we must confine it will allow, we shall divide it into four parts or sections: first, the general structural definition of a fish; secondly, a

very brief notice of the different parts of its organisation; thirdly, a short notice of the distribution and habits of fish; and fourthly, an outline of Cuvier's arrangement.

GENERAL DEFINITION. Fishes are vertebrated animals, having a double circulation, and breathing air, but only through the medium of water; their circulation is slow, and their blood, though red, is cold. The heart of a fish consists only of one auricle and one ventricle, answering to the pulmonary or right side ones of the double heart in the mammalia and birds; and the function of this heart consists in receiving the blood from the body, and sending it to the breathing apparatus, just in the same manner as the right side of the double heart in the mammalia does.

The breathing apparatus is very different from that of animals which breathe the free air. These receive the air into the cellular tissue of the lungs, or into the separate cells arranged along the sides of the abdomen (as in insects), and the vessels in which the blood is subjected to the action of the air are ramified over the walls of these cells. The breathing apparatus of fishes are called gills; and in their most perfect state they consist of fringe-like appendages attached to the posterior sides of certain arches of bone, which are articulated to the *os hyoides*, situated on each side of the neck, and have their ingress always by the mouth of the fish, and their egress always in the neck, and capable of being opened and shut by means of an apparatus which, taken altogether, is called the *operculum*, or gill-lid. The fibres or leaflets of the gills have their surfaces closely ramified over with a very fine tissue of blood vessels, which consist in the one part of arteries, and in the other of veins, as in the lungs of animals which breathe free air, or not through the medium of water. A current of water runs constantly through between the arches, and bathes the fringes on all sides when the fish breathes. This current is always from the mouth to the gill-openings; it is promoted by the joint action of the two; and if any attempt is made to force a passage for the water in the opposite way, or from the gill-openings to the mouth, as if by holding the fish head downward with the gill-lids open, then the fish is drowned, as certainly and as speedily by water, as a land animal would be by being kept the same length of time below the surface of that fluid. As the current of water passes through the gills from the mouth to the gill-openings, the blood, which is contained in the small vessels, which are ramified over the fringes of the gills, receives the benefit of the air which the water contains, to the same effect, if not in the same manner, as the blood in the lungs of an animal which breathes the dry air upon land.

When the blood has thus passed through the gills, and undergone that renovating process, it is not conveyed back to the heart as in land animals with warm blood, because there is no arrangement on the left side of the heart to receive it. The blood which returns from the different fibres of the gills, is conveyed by veins, which gradually unite with each other into an arterial trunk, placed along the spine, in what may be considered as the safest part of the whole cavity of the fish; and this cavity answers the purpose of a left auricle in receiving the blood from the breathing apparatus, and also that of a left ventricle in distributing it all over the body, in so far as the peculiar structure of that body renders the distribution of blood neces-

sary. The quantity of blood contained in a fish is, however, much less in proportion to the size of the fish than that contained in the mammalia or the birds; and so much blood is not necessary, because the greater part of the muscles being articulated on the spine, and inserted in the skin of the fish, appear to require the application of blood at the one extremity only. Thus, if a flesh wound is made in the body of a fish, which does not reach so deep as to divide the muscles down to the spinal column, such a wound does not bleed; and, in so far as we can judge, the fish feels very trifling pain from it, in comparison to that which a similar wound causes to an animal with a double heart, and warm blood distributed throughout all parts of the body. This exemption from pain in the case of laceration of the flesh is a very beautiful contrivance in the economy of fishes. Most of the race are very voracious, and very indiscriminate feeders; and not a few bite and tear in cases where they are not capable of swallowing the object of their attack. As the fish, when below the surface, is liable to attacks of this kind in all directions, the defence of insensibility to wounds which do not reach a vital part, is of great service to it; and if we attentively examine the structure of this class of animals, and the texture and character of their different parts, we shall find that their adaptation to their element, and to the circumstances of that element, is equally perfect with that of any other living creatures.

In one respect, fishes bear a nearer resemblance to birds than they do to any other of the vertebrated classes, inasmuch as their progressive motion is through one element, without any thing more solid, or of greater specific gravity, which they can use as a fulcrum or starting point to their motions, as is done by walking animals. The chief difference in this respect is, that fishes have to make their way through a medium which is very nearly of the same specific gravity as their own bodies; and thus there is nothing, independently of their own motion, to make them either ascend or descend. Birds on the other hand make their way through a medium of much less specific gravity than even the lightest of them; and thus in their motions they have a double operation to perform,—they have to keep themselves up against the pressure of their own gravitation, and also to make their way progressively; the fish is absolved from the performance of the first of these operations; and thus it can concentrate the whole of its energy upon its progressive motion; and thus, though it has to make its way through a much denser medium, it probably does not require nearly so much exertion as the bird. Any one who examines the general forms of fishes will observe that, notwithstanding their almost endless differences, they are all adapted for getting easily through the water; and, while the feathers of birds are in many instances so constructed as to take an absolute hold on the air, almost all, if not all, fishes have the surface of the skin supplied with a mucous secretion, which prevents them from even being wetted so long as they are alive, so that a fish gets through the water with much less resistance of friction than a dead substance of the same form and weight; and it is worthy of remark, how much more difficult it is to pull the body of a fish through the water after this mucous substance has dried, than when the fish is instantly dead, and this substance is fresh and abundant. As fishes require no support against the pressure of their own weight, they stand in no need of wings like birds;

and, as they do not move from a fulcrum or point of rest more stable than the water, feet would be equally superfluous.

Accordingly, the motive powers of fishes are more exclusively concentrated upon the spinal column than those of any other vertebrated animals. Even the ophidian reptiles form no exception to this, though they are in general destitute even of the rudiments of feet; for, as they start from a solid support in the successive portions of their motion, they act against that support by means of the scales on the under parts of their bodies and their ribs, which may be considered as a sort of substitute for feet; and, though many of the ophidia can swim well, even those which are habitually aquatic have no proper swimming apparatus. (See the article OPHIDIA.)

Fishes have, generally speaking, rudiments of four extremities, two anterior and two posterior, answering to the fore and hind feet of the mammalia; but these are often wholly concealed within the skin, and sometimes they are altogether wanting, especially the posterior ones.

A fish which is considered of the most perfect or typical form, has all these four extremities more or less produced beyond the skin; and their extremities consist of membranous tissues more or less entire, and supported by a framework of rays, which are in some cases continuous spines, in others made up of a succession of articulations, and in many the two kinds of rays are united in the same organ. These terminations have a rude resemblance to the fingers and toes of the human subject, or to the toes on the fore and hind feet of the digitate or toed mammalia. Those rayed and membranous appendages are called *fins*, which is the general name for all the proper organs of swimming or progressive motion through the water. The fins, which answer to the fore feet of mammalia and the wings of birds, are from their situation called *pectoral fins*. They vary much in form and size in different species, being short, or hardly, or not at all, developed in some, but not so much produced in others, as to answer the purpose of a sort of wings, during a short flight, or rather leap, through the air. They are, however, less frequently wanting than the fins which answer to the hind feet. These last are called *ventral fins*: they vary much in their situations, being sometimes placed far back, at other times far forwards, so as to be under, or even in advance of the pectorals; and in other cases again they are in a medium situation. The position of ventral fins is a very good character, not merely for the external distinguishing of fishes, but as an indication of the style of their swimming, and this again leads to some knowledge of the nature of their haunts and habits.

The pectoral and ventral fins of fishes are not, properly speaking, organs of progressive motion in swimming through the water; but they are to keep the body in such a position as that the proper swimming organ can act with the greatest advantage, and they are also useful in the keeping or the altering of the course through the water.

The really efficient fin in progressive motion is the *caudal fin*, or that attached to the extremity of the *vertebral* column, or tail. This fin is always spread out in a kind of fan-shape, but its termination is very variously formed in different species; sometimes it is squared over, sometimes rounded, sometimes wedged-shaped, and sometimes forked; but it is always placed on the same plane with the elongated pro-

cesses of the spinal column, or in a position exactly crosswise to that of the fan-shaped tail in birds. This shows the difference of use in the two organs. The tail of the bird is chiefly useful in ascending and descending, contributing nothing to the progressive motion, and very little even to the direction of that motion.

Besides the pectoral and ventral fins answering to the four extremities of mammalia and birds, and the caudal fin, which though it occupies the position of the tail in the other classes of vertebrated animals, yet performs a far more important function than that organ in any of them, the fishes have, in very many species, other fins attached to the extremities of the mesial plane, or that plane which passes through the centre of the spinal column and its processes. These fins are attached to additional bones, which are generally articulated to the processes. Those which are on the back of the fish are called *dorsal*, or back fins, and those which are on the under part, and which are always in the rear of the cavity of the body, and of course of the vent, are called *anal* fins. The dorsal fin is sometimes single, sometimes double; and there are many species in which the dorsal and anal fins are joined to the caudal one, forming a sort of finny margin round a considerable part of the mesial plane of the body. In fact, to describe all the varieties of those fins would be to enter very largely into the detailed description of the species.

What may be considered as the natural position of a fish, that is, the position in which the greater number of them are placed, both when they are at rest and when they are in motion, is with the mesial plane vertical, or in the direction of the perpendicular. The dorsal, the anal, and the caudal fins, have always the direction of this plane; and therefore in a fish which has what we have called the natural position, those fins have their planes or flat sides laterally, and their thin edges in the direction of gravity. From this it is easy to see that neither of those fins can in this direction produce, or assist in producing, either an ascent or a descent of the fish, because their action is across the direction of gravity, and therefore it can neither directly assist nor directly oppose that force. They strike laterally, and as we may consider that when the fish gives its stroke, there is a certain portion of their body forwards, which keeps the direction in which the fish moves, without any deviation either to the right or the left, we may consider some point, either the centre of gravity of the fish, or some point very near it, through which if a perpendicular, or line in the mesial plane, be supposed to be drawn at right angles to the axis of the body, then this line will be the centre upon which the propelling portion of the body may be supposed to turn alternately to the right and left, just as a paddle does when it is worked right and left across the middle of a stern of a boat. It will also be apparent that the greater the mass and weight of the fish which is before this centre of motion, the progress of the whole will be the more steady.

But though there is this analogy between the action of the posterior part of a fish and a stern paddle in a boat, we must not suppose that there is any comparison of the two in point of efficiency. The boat has no general principle of union and consent with the paddle; and it very often happens that the one is the worse possibly adapted to the other that we can well imagine. The fish on the

other hand, is one complete structure, actuated by a single principle, and having all its parts adapted to each other with a perfection of scientific principle which it would be vain for man to attempt imitating, except at the most humble distance. The fish does not bend the posterior part of its body right and left upon a single point, but brings it to a curve by an immense number of vertebræ; and in many species the pieces composing this vertebral column are in themselves so flexible, that the support of the muscles, or that which is moved in the striking of the fish right and left as it swims, may be compared to an elastic rod. But there is also something farther and more beautiful in this piece of mechanism. The muscles, or moving forces, are placed in flakes attached to cartilaginous septa or divisions, which proceed in an oblique, and generally in a curved manner, from the vertebral column and its processes, to the skin on each side; and this succession of muscular flakes is continued, not only the whole length of the posterior part which we have supposed to have the chief motion in ordinary swimming, but from the base of the skull to the caudal fin. The individual fibres of those muscles are placed, generally speaking, in a longitudinal direction, and their contraction bends the whole fish in a graceful curve towards the contracting side; and in cases of great exertion this curve may become an entire semicircle, nay, almost an entire circle with the muzzle touching the extremity of the tail, as may often be seen in a salmon when it attempts to leap a cascade of considerable elevation; nor would one readily believe, without actually seeing it, the height to which the unbending of this curvature by the action of the muscles on the other side can project the fish. This leap is of course taken laterally through the air; and so must be the leap of every fish when it rises to a considerable height out of the water—that is to say, the fish must project itself “broadside on,” but it is very remarkable that when it falls in the water, a cat does not fall more certainly upon its feet than a fish falls in that attitude of the body which is natural to it in swimming. It is further not a little curious, that if the fish falls upon land or on a rock, it does not right itself in this manner, but rather alights on the side, as may be observed of leaping salmon when they fall on the banks, or of flying fishes when in their attempts to escape from their pursuers they alight on the decks of ships. The mechanical action of fishes is, however, a matter which has been but little investigated; and though from the variety, the freedom, the rapidity, and very often the gracefulness of their motions, it is a subject fraught with a vast deal of mechanical information, it is one which, however desirable it would be, we cannot for obvious reasons prosecute further in a popular work.

PRINCIPAL ORGANS OF FISHES.—We shall give very short notices of the principal systems of organisation in the finny tribes, and leave the reader to generalise them. They may be conveniently brought under the heads of support, protection, sensation, motion, adhesion, respiration, circulation, nourishment, and reproduction; for we may pass over the systems of absorption and secretion, and refer the electric powers which are possessed by certain fishes to the particular descriptions of the *Gymnotus*, the *Torpedo*, and the various other species which have this property.

System of support.—This system consists of bones,

as it does in the other vertebrated animals; but the bones are of a softer consistency. Even the hardest of those which properly form parts of the skeleton, are to a great extent cartilaginous, and thus flexible, while others contain very little salt of lime. This affords a good general division of fishes into two very distinct and well marked sub classes; bony fishes, or those which have the bones more or less firm, and cartilaginous fishes, which have the bones flexible.

It would be foreign to our purpose to enter into a minute description of the skeleton, or indeed of the anatomy of any part of the fishes, and the subject is by no means an easy one, even for those who devote their chief attention to the structure of animals. The skeleton is in general very complicated, though comparatively concentrated into one mass, as compared with that of land animals, but the greater number of the articulations or unions of the pieces are quite different from these; and it is only in the jaw-bones and the dorsal and anal fins that we meet with any thing that can, properly speaking, be called a joint, or which consists of the motion of one bone immediately upon another. In every other part of the skeleton, the two adjoining pieces of bone are united by a greater or smaller extent of cartilaginous substance; and it is the yielding of this substance which forms the bending of the articulation, so that there is in the joint itself a certain degree of tendency to spring back again when it is bent, without muscular exertion. In mammalia and birds, the state of repose is a certain degree of flexure in which the joints are relaxed, and can be moved to some extent either way by very little external force; but the repose of the fish implies perfect straightness in the spinal column, and there is no relaxing either way, because all the muscles are equally in a state of repose, and the joints are held in an even state by the action of the cartilage alone. There is, perhaps, no animal in which rest is so complete and perfectly without effort or pressure upon any part of the body more than another, as in a fish when it is motionless in the water. The specific gravity of that fluid is of course exactly equal to that of the reposing fish, otherwise the fish would either sink downwards or rise upwards; and the water presses equally upon it in every part, so that it is impossible to conceive a kind of suspension more favourable to perfect inaction or waste of the system in any way, and this perfect rest is probably one of the reasons why fishes are capable of so much exertion at other times, and also why they appear to have unlimited powers of growth and endurance.

In taking the simplest view possible of the skeleton of fishes, we may consider it as consisting of a cranium, a spine, and ribs, together with the bones that support the lateral, the dorsal, and the anal fins. The cranium, or bones of the head, has no investment but the skin, and therefore its form is easily seen. It often consists of a vast number of pieces, but these generally soon become soldered together. The head is, generally speaking, united to the vertebral column by a single tubercle, and it has very little motion; few of the osseous fishes have any vertebra which can be called a neck, but some have, as, for example, the common herring, in which there are four. In the cartilaginous fishes the vertebra of the neck are generally soldered into one general piece. In the rest of the column the dorsal and caudal vertebra are easily distinguished from each other, as the latter

have processes both upwards and downwards, something in the form of a double comb, while the former have only spinous processes on the dorsal edge, and lateral processes on each side, which form the commencement of the walls of the cavity of the fish, protect a great or systematic artery, and in those species which have the ribs generally attached to them, the section of this column is sometimes cylindrical, sometimes angular, and sometimes compressed or flattened in the direction of the mesial plane. In bony fishes, each vertebra is composed of two hollow cups, of a conical form, the cavities of which are filled with fibrous cartilage; and in many species this cartilage extends through the centre of the column in one continuous cord for its whole length. The spinal marrow is not, as in land animals, contained within the vertebral column, but lies along the upper side of it, passing through the bases of the dorsal processes, which are all double at their origin, and may generally be split for their whole length. When the cartilaginous substance which unites the vertebræ or pieces of the back bone is examined, it has the appearance of a series of concentric rings; and it has been alleged that the number of these answers to the number of years that the fish has lived, but of this there is no proof.

The ribs of fishes vary much; cartilaginous ones have no true ribs, and in the bony fishes they are simple, forked, or double. In the carp family they are flat, in the cod family round, and in the herring they are like bristles. The number of ribs, and also of vertebræ, are good characters in distinguishing the several species of fish.

Besides the parts already mentioned, the only portion which can be regarded as directly connected with the skeleton, is the bony structure of the shoulder, or that which supports the pectoral fins. These consist of the two arches which, in fishes that have regular gills, always support the posterior edges of them, and furnish a place of resistance against which the gill-lids close, as well as give security to the anterior part of the cavity of the body. When perfect, these arches are united at their under extremities by cartilage, and at their upper ones they are attached to the vertical column, to the posterior part of the cranium, or to both. To these arches are attached, not by regular joints but by cartilaginous unions, the bones of the pectoral fins, which usually consist of two pieces, answering to the arm and fore-arm, and some small bones at the extremities of the latter, which have some analogy to the bones of the wrist. To these last the rays of the pectoral fins are attached. The bones which support the dorsal and anal fins are generally detached pieces, included in the flesh, though in some instances the dorsal is joined to the processes of the spine, and more rarely the anal to the same. When the ventral fins are situated as far forward as the pectorals, or farther, they are connected with the same bones, sometimes through the medium of an imperfect sternum or breast bone. When the ventrals are situated farther in the rear, the bones to which they are attached are most commonly imbedded in the flesh, without any connexion with the vertebral column.

The bones of the head are so many and complicated, and they vary so much in different species, that they cannot easily be made the subject of popular description. The bones of the jaws are generally very distinct from those of the cranium, and admit of

separate motions, and there are peculiar bones in the pharynx at the back of the mouth. The bony arches which support the gills are attached at one extremity of the os hyoides. The gill-lid consists of several plates of thin bone, which, in the fishes which have free gills, have a good deal of motion, and by expelling the water when they close, not only perform an office in respiration similar that of the raising of the diaphragm in the mammalia, but also, by the force with which they throw the ejected water backwards, assist in the progressive motion of the fish.

We have already mentioned that the bones of fishes are, generally speaking, of more flexible consistency than those of land animals, and contain proportionally less of the salts of lime. Their base of animal matter is different from that of the mammalia, as it does not appear that they contain much, if any, gelatine. Their composition has not been determined by any very accurate analysis; but it should seem that they are so far intermediate between the bones of land animals and insects, such as those of crabs and lobsters, for they contain a portion of sub-carbonate of lime as well as of phosphate, only the quantity of the latter is more abundant. The bones of some fishes undergo a very remarkable change of colour when they are boiled; thus the bones of the blenny become green, or rather, perhaps, they are green without any boiling, as is the case with those of the gar-fish (*Belone*), which has also often been alleged to turn grass green in boiling, whereas it is green whether boiled or not, only the bones of fishes are seldom objects of common observation till they are boiled.

Protecting organs. Under this name we do not mean to include only those means of defence which fish have against their enemies; but their general means of protection against the macerating influence of the element in which they live. These may be divided into the three distinct processes of skin, scales, and spines.

The skin consists of three distinct parts, a true skin immediately over the muscles, a mucous tissue, and an epidermis or cuticle. In those species which have no scales, or very small ones, the true skin is often very thick, while in those which have the scales large it is often a very thin membrane. It adheres much more closely to the flesh than in any other of the vertebrated animals. When thick it contains a great quantity of gelatine, and as such it is useful as food, as glue or size, and for many other purposes. The skins of the cod and eel are instances. The skins of fishes have none of those villi or papillæ which are found on the skins of the land vertebrata, and which are generally supposed to be organs of a sense of touch, and hence it has been supposed that fishes have little feeling of this sense. This is, however, to a very great extent hypothetical; for even in land animals these papillæ are by no means the most delicate organs of this supposed sense of touch, for they are in all probability excelled by the whiskers of nocturnal beasts of prey, the margins of the wings of bats, and the fine and filmy terminations of the feathers of nocturnal birds. It is very doubtful if there be any such thing as an organ of touch *per se* in any part of the integuments in any animal; and the more rational view of the case is that the feeling is in the muscle, and the only office which the external integument performs is that of readily transmitting to that any impression made on itself. Every schoolboy who

has access to the smaller streams inhabited by trout, knows that if a trout under the bank be tickled, it will press against the hand as if very much pleased with the operation; and that if tickled sufficiently it may be lifted out of the water without offering any resistance.

The mucous tissue is understood to be the seat of colour in all animals; and in the fishes it is remarkable for its brilliant tints and iridescent reflections, the finest of which in general fade, when the fish is dead, and this tissue becomes dry and rigid. The epidermis is very soft in fishes, and very generally covered with a mucous secretion. It extends to the scales as well as to those parts that have none, and it also moistens the shells of aquatic mollusca in the living state. In fishes it appears to be seasonal, as it often comes off in patches of considerable size, when there is no reason to think that the fish is unhealthy.

The scales of fishes are placed on the epidermis, or rather they consist of thin tissues of epidermis with layers of phosphate of lime between, and it is to this structure that they owe their fine pearly lustre. Generally speaking they are imbricated, or placed over each other like the tiles on a roof, with their posterior margins free and generally rounded, and often with a fringed margin. When they are examined by means of a powerful magnifier, they show a very beautiful ramification of striæ, or little threads. When the fishes are in fine condition, and especially toward the season of reproduction, there is a beautiful bloom and metallic lustre on the scales, in the same manner as there is on the feathers of many birds; but when the season of reproduction is over, and the fish are exhausted, as they always are upon these occasions, the bloom goes off, and the surface is dull and lustreless. The fish are unwholesome when this is the case, and the rich and pearly lustre of the scales is one of the surest signs of the fish being in season, equally sure as the bright red of the gills is that it has not been too long kept. This is remarkably the case with salmon, the pearly hue of which is very rich when they first enter the estuaries of the rivers, but it wears off; and when they have spawned they are vernacularly termed "black fish," in which state the capture of them is prohibited, though poachers do sometimes take them, then and sell them at no small hazard to the lives or at all events the health of the purchasers.

In many species there are osseous plates, or tubercles, or spines, instead of scales; and where these occur they have always more the consistency of hard bone than the internal skeleton of the animals; nor is it unworthy of remark, that these bony appendages to the skin are, generally speaking, more general among the cartilaginous fishes, than among those that have harder skeletons. The sturgeons have the surface of the body studded with osseous plates resembling limpet shells; the sharks have it granulated with tubercles; and many of the rays have it beset with very hard and sharp hooked spines resembling teeth; and all these are cartilaginous fishes, with little or no hard matter in their internal bones.

It is farther worthy of remark, that this tendency to accumulate the salts of lime in the form of scales, plates, tubercles, and should accompanies the formation of gelatine, which, though found in very small quantity or not at all in the bones, exists in vast quantity in the skin; so much so that our best glue and finest jelly are obtained from the membranes of

fish. Nor is there any doubt that if the trimmings of the fins of fish, which are thrown away in such quantities, were collected and prepared by the removal of the fatty matter (which is chiefly *elaine* or oil fat, and might also be turned to valuable account) and the other foreign substances, a great quantity of an article very wholesome and nutritious as food, and very useful in many of the arts, might be recovered at little cost from absolute waste.

The protecting substances which we have now mentioned, do not appear to be in any case intended as direct defences against enemies; but they, the scales especially, answer some very important purposes in the action of the fishes; and it is worthy of remark, that those fishes which have not imbricated scales with their margins free, are either more long and flexible, or their fins more expanded, so that they are less active in swimming than those which have freer edged scales. The size of the individual scales does not appear to be a matter of much importance, so that the edges are free, because upon an equal extent of surface small scales are probably as advantageous as large ones.

The action of the edges of the scales is this: when the fish bends the body strongly to one side in the act of swimming, the force of the stroke would throw the head in the other direction, and a certain portion of the effort would be expended in actually driving the fish back; and this counteracting portion would always be the greater fraction of the whole, the more powerful the stroke, or, which is the same thing, the greater the flexure of the body. But when the fish is covered with scales, the posterior edges of which are free, any flexure or stroke of the tail toward one side must cause a proportional rising of the edges of the scales on the other, and the edges thus raised must each lay hold of the water, and not only prevent motion backwards, but give considerable effect to the stroke.

But besides these which we have mentioned, there are other spinous appendages to the coverings of fish which are of a more formidable character, and which may be regarded in the light either of offensive or defensive weapons. These have rather the form of spines, very sharp at the points, by means of which punctured wounds can be given, and they are often finely granulated over their surfaces, so that while they penetrate they lacerate like a file, and the wound is of a cankering and festering character; so much so that there is a belief that some of these species are poisonous, as is alleged of the spine of the dorsal fin in the dragon weever, *Trachinas draco*. That poison should be secreted on a spine in the fin of a fish, subjected to constant washing in the sea, and without the least vestige of a poisoning apparatus, which is always very complete and apparent in those animals which are known to inflict poison, would be rather singular; and though it is the general belief among those who receive wounds from these fish, there does not appear to be any more truth in it than there was in the old story of the deer poisoning those that were wounded by his antlers. It seems to be nothing more than a ragged wound which is inflicted in those cases, and we know that such a wound given by a steel instrument will often produce the most serious consequences.

These spines are placed in different parts of the body in different fishes. In the fins on the sides of the tail, on those of the head, on the gill lid, on the

shoulder, and on various other places ; and when a large spine of this description is observed upon any part of a fish, it is always prudent to keep out of the way of it, so long as the fish is alive, as no animal, either of the sea or the land, is ever furnished by nature with a weapon without being at the same time endowed with the faculty of using it in the most effective manner. Even the lesser weever, which is a little thing about five inches long, will strike upwards, or right and left, and inflict very painful wounds with the spine of its dorsal fin, small as it is.

Organs of motion.—We have already alluded to this, both in the fins and in the muscles by which these are put in motion ; we shall therefore merely make one or two general remarks here. Every one who examines the muscular structure of a fish, and observes that each side of the whole body, from the nape to the tail fin, consists of a rough mass of muscle, cannot fail to perceive the great advantage that arises from the division of this mass into so many different flakes, each of which is really a separate and independent muscle, receiving its own nerves and vessels from the spinal column without being in the least dependent on the others, and yet all of which can act miscellaneously and in concert whenever such action is necessary. So also, in consequence of this division of the mass into independent short lengths, the greater part of the fish may become not a paddle merely, with the fin on the tail, but an action something analogous to that of a many-oared cutter, striking right and left at the same time, and thus making the way of the animal in a perfectly straight line, while it is apparently turning along like a corkscrew. We have a very neat example of this in the common eel, the motions of which are close, but performed apparently in the most smooth and easy manner imaginable, and with the least possible fatigue. Then if there is a cross current to contend with, or anything else that causes more resistance on the one side than on the other, the greater power of the action can instantly be thrown where the greater effort is required, and the fish can keep its course without drifting, where any other creature would be completely at the mercy of the current.

Nor must we overlook the advantage of this accumulation of muscles in the event of any local injury taking place. The limbs of mammalia, and the wings of birds, are in their several articulations dependent on few muscles, and those of the one joint do not assist those of the other, so that if one is rendered unserviceable the whole limb is crippled. But in the compound muscle of a fish, though one or more of the flakes happen to be deeply wounded, there are still many others performing the very same office, and thus a very severe wound in one place will not greatly lessen the swimming power. This is of great service to fishes as a protection against each other. As is usually said, the fishes “care not a rush for the weather, but make themselves happy in eating one another whether it is foul or fair.” Now this is very nearly, if not altogether, the literal fact of the case ; and so, when numbers of them are congregated together in one place, and the shoals often amount to many millions, numbers of them must be constantly getting bites ; and if they were as much affected as land animals are when bitten or torn, the sea would literally be encumbered with crippled fish. Anglers often catch a trout or a salmon which probably an otter has made pay the forfeit of nearly a

pound of flesh, and yet, with a great notch in his back, if it does not reach down nearly to the spinal cord, a fish will take the bait, or rise to the fly with nearly the same alacrity as if his skin was whole.

There is one other consideration worthy of notice with regard to the general condition of the organs of motion in fishes. They have really less work to do than the organs of any other animals, not excepting their neighbours of the deep. The crustacea have a dead weight to carry ; and, in the case of a crab or a lobster, this dead weight forms no small fraction of the whole. So also the shelled mollusca have often to carry about five times their own weight in the house which they make for themselves ; and this house is always specifically heavier than sea water, so that those which rise to the surface require a particular apparatus for floating it upwards. Land animals have also their own weight to carry ; which, making allowance for difference of structure, appears to be almost equally laborious in those which walk and those which fly. But a fish has no weight to carry ; for though, of course, the total pressure of the water increases with the depth, the specific gravity varies but little, because water is not much compressible ; and from what we experience ourselves when exposed to different degrees of atmospheric pressure, we can readily understand that a fish may be as comfortable under the pressure of a hundred atmospheres of water, as a land animal is under that of the light atmosphere of a mountain top. Thus the only exertion which a fish requires to make is that which conducts it from place to place, either in search of its food, or on those journeys which many fishes perform seasonally, chiefly with a view to breeding. This appears to be the reason why fishes have so few blood vessels in the muscular parts of their bodies. From what we know of circulation, we may safely conclude that the waste of the system, or of any part of the system, is in proportion to the number of blood vessels, and the quantity of blood which circulates through them. Now birds, and especially mammalia, have those vessels so completely ramified through every part of their bodies, except the solid bones (and there is blood in various bones of the mammalia when young), the tendons and the simple membranes, that no part of their system can be lacerated, or even scratched, without the effusion of blood, for the skin itself is full of blood vessels ; but before red blood can be obtained from a fish, the wound must be a pretty deep one, unless it is given through the tissue of the gills, through which the blood passes. We have already mentioned the names and situations of the principal fins ; and so we have only to say a few words upon the difference of position in the abdominal ones, which are those that most differ in position ; and this is all that is necessary to be attended to in a general glance, because the relative shape and degree of development in the different fins properly form part of the particular descriptions of the races. Now, in those species which have the ventral fins placed backwards, we generally find that the usual line of motion in swimming is nearly horizontal ; and, in proportion as the ventral fins are brought farther and farther forward, the fish in its habit has more occasion to exert itself in raising the head upward when it moves from place to place. In general, too, those fishes which have the ventral fins far backwards, have the body spindle-shaped, and the head not very large ; whereas those which have these fins brought so far forward as to be connected with

the same arches of bone which support the pectorals, have the head large, and the whole of the anterior part of the body thick and heavy, as compared with the posterior. Some fishes are, no doubt, of such odd shapes, and have so many extended filaments, and other curious appendages, of which nobody knows the use, attached to different parts of their bodies, that we are unable to apply any of the principles of our mechanics of simple forms to their singular structures; but still we find that, whenever the form of the fish is so simple that we can deal with it as we would do with a common mathematical solid, we find that the above stated principle applies; and that, whenever the ventral fins are brought forward near the throat, in aid of the pectorals, the anterior end of the fish is always the heaviest, and requires this additional apparatus for the purpose of lifting it up. The *plenyopterose* fins are at right angles to the axis of the body; and thus, while the posterior or progressively moving part impels the fish forward, the accumulated fins under and on the sides of the throat, strike downwards against the water, and thus give an upward motion to the anterior part of the body. Fishes which have this enlargement of the head, and condensation of the lateral or cross fins near it, are, generally speaking, ground feeders; and, when they are feeding, hang at an angle with their heads lower than the hinder parts of their bodies; and, in this way, pick up molluscs, and other small ground animals. Those fishes which are altogether without ventral fins, and which are sometimes styled *apodal*, or footless fishes, generally remain quietly at the bottom, and seldom approach the surface. They are all of the *anguilliforme* or eel shape, with lengthened and slender bodies, and the pectoral fins close to the head, and generally lower down than in those fishes which have ventral fins under the pectorals. The use of these pectoral fins, which are in general pretty much produced, is to guide the head in any direction, upwards, downwards, or laterally, and not chiefly for the purpose of raising it, as in those which have the two sets of fins concentrated together near the same point. In most fishes the motion in advance is not produced so much by the stroke of the caudal fin as by the contrary throws of the posterior part of the lengthened body; and in order that that may be a more effective swimming apparatus throughout its whole length, the dorsal and anal fins are, in general, continuous, and meet at the extremity of the tail, where they in general form a rounded or pointed terminal fin.

Though ground fishes, those which have this structure are not exclusively, or even generally, ground feeders. They range the waters near the bottom, but they range them in line, and feed upon that which moves in the water, rather than that which is quiescent at the bottom.

The principle now stated, and it is a very interesting one, in what may be styled the mechanism of fishes (one of the most interesting branches of natural mechanics, because it presents us with motion directed only against one resistance, that of the water), cannot be better illustrated than by a reference to Cuvier's division of the *Malacopterygii*, or fishes with soft or jointed rays to their fins; and this allusion will at the same time show the beauty of the systematic arrangement, by that matchless adept in knowledge of the structure and functions of animals.

Cuvier divides this class into three families:—*Abdominales*, or those which have the abdominal or

posterior pair of fins placed backwards; *Subbrachia*, or those which have the second pair of fins placed forwards, either immediately under the pectoral fins, or sometimes in advance of them; and *Apoda*, or those in which the ventral fins are wanting. The tribes of fishes which come under the first of these families are the *Cyprinidæ* or carp family, the *Esocæ* or pike family, the *Siluridæ*, the salmon tribe, and the herrings and allied species. All of these are straight-forward swimmers, and the greater number of them are found near the surface of the water. They are, generally speaking, what we are accustomed to call handsomely proportioned fishes, rather long than otherwise, and, generally speaking, they are rapid in their progressive motions, and not remarkable for the facility with which they can plunge to great depths, or rise from them.

The second family, or those which have the ventral fins concentrated near the pectorals, and, generally speaking, articulated to or connected with the bones of the shoulder, comprehend the eel family in all its genera; the flat fishes, or different species of flounders, soles, turbot, and other genera and species of that type; and the *discoboli*, or those fishes which have the ventral fins formed into a sort of round disc on the under part of the body. All these are bank fishes to some extent or other, or if they are not found on banks of sand or mud, they frequent rocky places; and, generally speaking, feed near the bottom. In most of the species they are not very discursive, but remain on the same grounds, often accumulating in vast numbers; and one of the chief uses of the concentration of the four lateral fins at the anterior part of the body appears to be, to enable them to get over the inequalities of that bottom over which they find their food. The flat fishes deserve perhaps a particular notice on account of the particular position of their bodies when swimming, which is really with the side uppermost, and not the back, though the upper surface is coloured like the backs of ordinary fishes, and the under surface like the belly. There is, however, a twist at the insertion of the head, which gives a very peculiar appearance to that part of this tribe of fishes; but it will be better to notice their general characters in a separate article *FLAT-FISH*, than to break the chain of illustration in the present one, or extend it to greater length.

The third, or apodal family of this order, consists entirely of elongated or eel-shaped fishes, which, like the former are ground-fishes, and perhaps upon the whole remain constantly nearer the ground than they; but they swim by contrary flexures of the body, and not by the stroke of the tail, as an oar. There is sometimes a vulgar prejudice against this class of fishes, in consequence of their snake-like form, and snake-like movements. The slightest attention will, however, suffice to convince any one that their motions are those of true fishes, and not of ophidian reptiles, even aquatic ones. The motion of these reptiles is always in the vertical plane, so that, even when they swim, the flexures or bendings of the body are upwards and downwards. Those of the apodal fishes, even of the most snake-like of them, are, on the other hand, always lateral, and they have little or no power of bending the body in the direction of the mesial plane, that is, in the direction of the edge of this plane. In passing we may here remark, that the curved form given by painters to their imaginary dolphin is perfectly inconsistent

with the mechanical structure of a fish; and that however a fish may be able to bend itself laterally, or even obliquely, there is no provision in the muscular structure of any one fish, by means of which it is able to bend the spinal column either upwards or downwards. The bending of flat fish toward the pale coloured side especially, must not be considered as an exception to this; for the flat fishes, as we have said, swim on their side; and the finned margins of their disc are as truly the middle of the back and middle of the belly marking the terminations of the mesial plane, as if they swam with that plane in the vertical direction and not in the horizontal. These few remarks must suffice in the meantime, for the various motions of the different fishes are so curious, and involve so many points in mechanics, that if we were to allow ourselves to get entangled in the details, there would really be no end. The subject is simple however, and as, in addition to this, it is highly instructive as a mechanical subject, it is eminently deserving of every reader's most careful attention and most diligent study.

Organs of adhesion.—The consideration of this branch will not detain us long. Fishes, generally speaking, have no apparatus, excepting the mouth, by means of which they can take hold of any one substance, and therefore, excepting in so far as they can counteract by means of their swimming apparatus, they may be said to be at the mercy of the waves. That apparatus is, however, so efficient; and the waves produced by surface agitations reach to so very small depths in the sea, that, generally speaking, the fishes may be said to be perfectly independent of them, except some of the lighter surface fishes, and the small fry which are occasionally caught in storms, and stranded on the shores in countless numbers.

There are, however, countless fishes which, from the peculiar places in which they seek their food, and the peculiarity of that food itself, have to hold on in the strength of currents, which would be too much for the fins of even the strongest and best formed of the finny tribes; and those species to which nature has assigned this habit, have of course received an adequate means of adapting themselves to it. The apparatus used for this purpose is a sucker, or cartilaginous disc, which this fish can apply so firmly to the surface of any solid object, fixed or floating, as that no action of the water can detach it. This sucker, when it is a mere means of stability, is placed either on the head or the thorax. In the remora, which has been so long celebrated, and of which so many ridiculous stories have been told, and of which as a genus, some account will be found in the article ECHENIS, the sucker is of an oval form, and consists of transverse rows of cartilaginous plates connected by one edge to the surface of the head, and in the other edge free, and finely pectinated. A longitudinal partition divides the plates in the middle of the head, and in the spaces between the plates, and on each side of the partition, a row of fleshy tubercles may be observed. In the *eyelopteri* this organ is of a circular form, and consists of numerous soft papillæ. It is situated on the thorax. Instead of a separate organ of adhesion, the ventral fins in the goby are united, and are capable of adhering to rocks and stones, while in the lamprey the mouth contracts and acts as a sucker. All the species which have suckers of this kind for the purposes of mere adhesion, whether those suckers are placed on the upper or the

under part of the body, belong to the subbrachian family of the soft-finned fishes. They are generally, if not all, fishes of feeble powers; but the sucker enables them to adhere to rocks over or under them, according as it is at the top of the head or under the body; and while they so adhere, secure against the current, they are enabled to capture for their subsistence the fry of fishes, and other small animals which the current carries along. Of course they are not found in the placid waters, where this apparatus would be of no service to them, but chiefly in passages among rocks, through which currents set with much rapidity.

Some of the cartilaginous fishes are also furnished with suckers; but the suckers which they possess are placed on another part of the body; and generally speaking, calculated for other purposes. They are on the mouth, as in the lamprey, the pride, the hag, and some varieties; and though these are found at least in some of the species, occasionally adhering to stones with great firmness, yet the principal use of the sucker appears to consist in enabling them to extract their subsistence from the bodies of animals to which they adhere; and among them the hag, which is in appearance little else than a gelatinous sac, often sucks the substance of eod and other fishes while they are fast on the hooks of the fisherman's lines. See the article MYXINE.

Respiration and Circulation.—Both the organs and the process in these have been mentioned in the general preliminary remarks, so that it remains only to notice the differences which are found in different kinds of fishes. The respiratory organs are perhaps to be regarded as the most perfect and typical of a fish, when the gills are distinct upon the bony arches and face, and the gill openings ample and furnished with the most complete apparatus in the gill-lid. This part of the apparatus is sometimes wanting, but the gills themselves never are. When it is most complete, then is the gill-lid itself placed on each side of the head immediately behind the eye, articulated to the bones of the head, and shutting in the rear against the bony side of the shoulder, especially the large bone which answers to the humerus; and the lower extremities of both of which are riveted by a fleshy cartilage, and a similar substance ties them to the os hyoides; thus uniting the parts against which the gill-lids close with those to which both they and the gills are attached. This gill-lid is, in its external texture, either scaly, or membranous, or bony, and it is sometimes furnished with one or more hard tubercles or spines. Internally, it always consists of thin and flexible plates of bone, composed of a greater or small number of pieces in different places. When it consists of many, the one next the head, which is often double, is called the *pre-opercule*, the one behind that, toward the upper part, the *opercule*, below that there is the *subopercule*, and between this last and the extremity of the os hyoides, the *inter-opercule*. The posterior margin of the gill-lid, including under that name all the pieces above enumerated, or as many of them as may exist in the species, is variously toothed, though sometimes it is plain. In the greater number of fishes it is furnished with a fin-like appendage, called the gill-flap, which is supposed to contribute in some way or other to the action of the lid itself, and consequently to the breathing of the fish.

Count Lacépède founded a good deal of the clas-

sification of fishes, upon the form of this organ, but the classification has not been followed by more scientific and discerning ichthyologists; and indeed the breathing apparatus, especially in its more minute variations, is but ill calculated for being the foundation of any arrangement. In the distinguishing of species it may, like the number of rays in the fins, and of vertebræ in the spine, be of some use, because we believe it is pretty constant in the same species; but it is so obviously a character which leads to nothing, that it cannot be made the basis of anything more general in an arrangement which professes to assist in the study of fishes. All fishes breathe atmospheric air, and they effect this through the medium of water, the quantity of which is in all cases very much greater than that of the air, and it is every where very much the same. So that the character of the breathing apparatus is to be inferred from the habit of the fish, rather than the habit from the peculiar structure of the apparatus; and even when taken in this way there is not much in the inference. Thus, for instance, the eel and other apodal fishes, which move about at or near the bottom of the waters, generally have the gill-openings very small, and are without a gill-flap, a gill-lid, or both; while eod and many other bank fishes, which feed at the bottom, have the gill-openings unusually large, and the lids furnished with flaps. The number of rays in the gill flap, which are technically called "branchiopterygeous rays," are, however, admitted into the list of characters in the subordinate divisions.

In fishes which have free gills, inserted upon arches of bone attached to the os hyoides, there are usually eight, four on each side, answering symmetrically to each other, both in form and in magnitude; but in some there is an additional small gill on each side, though it does not appear that any inference can be drawn from this as to the general habits of the fish, for it occurs in the herring, which is a surface fish, and also in the sole, which is a bank or ground one. The upper ends of the gill arches are attached through the os hyoides to the general mass of bones in the head, the under ends are attached to the bones of the tongue. The motion of that organ of course moves the arches, and they are besides flexible through their whole length. The anterior edges of the arches toward the mouth are covered with the same kind of integument as the rest of that cavity; they are generally more or less tuberculated; and in many species they are beset with teeth, and assist in the operation of conveying the food to the stomach.

In the *Chondropterygii*, or cartilaginous fishes, the gills are much less perfect. They are fixed to partitions, which answer nearly the same purpose as the arches of bone in the other fishes; but the fibres are very similar to those in the others, which shows that though the apparatus is different in form and arrangement, the operation to be performed is substantially the same. Some general notice of the structure of these fishes will be found upon looking back to the article CHONDROPTERYGII; but as the subject is rather a curious one, we shall add the details of some of the species as given by sir Everard Home. "In the lamprey," says sir Everard, "the organs of respiration have seven external openings on each side of the animal; these lead into the same number of separate oval bags, placed horizontally, the inner membrane of which is constructed like that of the gills in fishes. There is an equal number of

internal openings leading into a tube, the lower end of which is closed, and the upper terminates by a fringed edge in the œsophagus. These bags are contained in separate cavities, and enclosed in a thorax resembling that of land animals, only composed of cartilages instead of ribs, and the pericardium, which is also cartilaginous, is fitted to its lower extremity like a diaphragm." In the hag, or myxine, there are only two external openings, one on each side; but there are on each side six lateral bags, to each of which there passes a tube from the external opening; and close to the left external opening there is also a tube which passes to the gullet, and forms a communication with the mouth. In the common chondropterygii which have their mouths of similar construction to those of the bony fishes, and which seize and swallow their prey, it may be presumed that the ordinary mode of breathing resembles that of other fishes, that the water is partially at least received by the mouth, and discharged by the gill-openings; and the communication which there is between the gills and the gullet in the lamprey and the myxine shows that they also, occasionally at least, receive water in the same manner. But the lamprey occasionally, and the myxine habitually, in feeding, adheres by the mouth as a sucker; and when this takes place of course neither air nor water can enter by that orifice; and thus the whole operation must be performed by means of the bags or cells, to the walls of which the fibres of the gills are attached. Hence there must be in this apparatus, a means of receiving and discharging the water, independently of all action of the mouth; and it is worthy of remark that in this respect those fishes bear no inconsiderable resemblance to insects which breathe wholly through apertures in the sides, which have no communication whatever with the mouth. The method in which this operation is performed, in the lamprey and myxine, is thus described by sir Everard Home:—"In the lamprey, the water is received by the lateral openings of the animal into the bags which perform the office of gills, and passes out by the same opening; the form of the cavities being fitted to allow the water to go in at one side, pass round the projecting parts, and out at the other. A part of the water escapes into the middle tube, and from thence either passes into the other bags, or out at the upper end into the œsophagus. There is a common opinion that the water is thrown out of the nostril: this, however, is unfounded, as the nostril has no communication with the mouth. In the myxine, the elasticity of the two tubes and the bags into which they open, admits of the water being received; and the pressure produced by the action of the external muscles forces it into the œsophagus, from whence it is thrown out by the opening at the lower end of that tube.

This operation appears to be performed by means of the cartilaginous ridges which are attached to the skin between the gill-openings. When the water is to be received, these arches are extended outwards, like a bow, by their extremities being moved by particular muscles; and thus cavities are formed, and as instantly filled by the pressure of the water. When this water has remained for the requisite time the ridges are unbent and drawn inwards, and the water is expelled; and this operation being repeated, constitutes the process of breathing in those peculiar fishes, altogether independently of the mouth.

In the ordinary breathing of fishes by the mouth, it

must not be supposed that the process, even in the mechanical application of the water to the gills, consists of a mere current, running without intermission in at the mouth, and out at the gill openings; for, as the separation of oxygen from nitrogen in the free air received into the lungs of land animals, requires some time for its performance, we may naturally conclude that more time will be required for performing the double operation of separating the air from the water, and then the oxygen from the nitrogen. This is also an operation which the fish can suspend at pleasure for a short time; but in the generality of fishes this time is very short. There is also rather a complicated operation of the mouth, which aids the current of the water when breathing. There is a sort of double mouth, the inner portion of which (which in many fishes is pretty far back) shuts, and shuts close on the anterior edges of the gill arches, so that when the gill-lid, or flap, or whatever it may be, is pressed down, the water, which has been wholly exhausted of its air, and is, therefore, unfit for the purpose of respiration, is wholly expelled from the gills, and as soon as this inner gate of the mouth is opened, and the gills expanded, fresh and wholesome water is admitted.

In ordinary fishes, there is no return by the mouth of the water which has once been received by the gills, and any thing which prevents the discharge through their openings, is just as fatal to the fish as if the supply by the mouth were excluded. If the ejection of the water from the gills of a fish be prevented, by the gill-cover being tied down with a string, it soon expires in convulsions. Similar fatal consequences follow when fish are placed in water previously deprived of its atmospheric air by boiling or freezing: and when fish are kept in a small pond, whose surface is frozen over, and where the water in that case cannot obtain a fresh supply of air, they speedily perish. If a small opening be made in the ice, before it be too late, the fishes will come near it for a fresh supply. In this manner fishes are frequently taken during winter in ponds and lakes. The extent of surface presented by the gills of a fish, to enable the blood to come in contact with the air in the water, is much greater than one would, without attentive consideration, be led to suppose. Dr. Monro calculated, that the whole gills of a large skate presented a surface equal to two thousand two hundred and fifty square inches, or equal to the whole external surface of the human body. The process of respiration for the supply of the gills is carried on even during sleep. The number of respirations in a minute is seldom above thirty, or below twenty. In the same individual it is liable to considerable variation, depending on the will of the animal. The blood, after being renovated in the gills, is re-absorbed by a multitude of minute vessels, which unite together; but, instead of returning the blood to the heart again, to be afterwards distributed through the body, this aorta exercises that function, and descends along the inferior side of the spine, in a canal fitted for its reception, giving off arteries during its course, to the adjacent parts. The blood is absorbed again by veins, which have extremely thin coats. These are much larger in their course than at their termination; and besides form, in different parts of their course, considerable receptacles for blood. Any injury received by the gills of fishes is attended with much pain, and a considerable effusion of blood. Some fishermen seem to be well aware of this last circumstance, and cut the gills with a knife as soon as the

fish is taken. A copious bleeding takes place; and they find that a fish so killed will keep much longer in a fresh state than one on which this operation of bleeding has not been performed. There are some other circumstances connected with the respiration and circulation of fishes, of which it is necessary to take notice, in order to have a full and distinct view of the economy of those most useful and interesting animals.

The heat of all animals is found to be in exact proportion to the energy with which their system works; and the best indications which we have of this energy are, the quantity of air required in respiration, and the velocity in the pulse of the circulating blood. These do not keep time with each other exactly, because time is only one element in the amount of either, and quantity is the other element, so that we must take our estimate from these two jointly. But respiration admits of much more variation as to quantity, in the same time, than circulation does; and, therefore, there may be many changes in the rapidity of breathing, arising from temporary causes, without any effect upon the pulse. If, however, we take the general habit of any animal, we shall find that there is, upon the whole, a correspondence between the two; and that the heat is in proportion to the intensity, taken jointly. This, by the way, is the only rational view of the source of animal heat, a subject upon which so much ingenuity has been wasted, and so many theories have been proposed and abandoned. Sensible heat, notwithstanding all that may be said about it, is not a thing, it is a mere accompaniment, the measure, or at all events the indication, of a certain degree of intensity of action. Nor does it appear to signify much of what kind this action may be, whether chemical, mechanical, living, or any thing else; for we have not only every reason in argument for concluding, but we have the evidence of facts to prove, that any one of those modes of action of any kind which we can name, might be brought up to such a degree of concentration and intensity, as to produce combustion in inflammable substances, or, as we say, kindle fire. We have proofs of this in the action of the animal system, in those cases of spontaneous combustion, which are too well and too minutely authenticated for leaving any room to doubt their truth, though, for the details of these, we must refer to the article COMBUSTION (SPONTANEOUS) in this work.

But whenever we would approach the subject of animal life with any thing like knowledge, it is necessary that we should always refresh our memories on this same subject of animal heat; because there is no one subject in the whole wide field of physiology in which the ignorant are so much at a loss for the way, and the learned so deeply bemired in their own fancies.

As the temperature of the element in which fishes live is never high, and varies but little, as they have nothing to do but move about, and eat, and propagate, without any burden, even of their own weight, to bear; as they have but little blood, and that blood has a slow and limited circulation, one might naturally infer that they would have a low degree of temperature, and observation shows that it is in some cases, at least, lower than the temperature of the water in which they reside. The deposit on the great bank of Newfoundland, which affords food for such inexhaustible shoals of cod, is usually, and we think with reason, understood to be made by the warm current which comes

from the tropical seas; and yet cod, when taken there at the depth of about forty fathoms, have an average temperature of about forty-one or forty-two degrees, or nearly that at which water has the greatest density, though the water at the surface may be sixty degrees or more. We are not aware that the temperature of the water, at the depth from which the fish are taken, has been observed at the same time with that of the fish, but the surface temperature has; and when we consider that the whole, or at least the greater part, is one current, we must conclude that at forty fathoms or 240 feet, it must be considerably higher than the observed temperature of the fish. This is a process on which it would be desirable to have many observations in different seas, and on different kinds of fish; because, as we cannot follow them in their submarine abodes, and study them there, we should procure intelligence of them by every means in our power.

The changes of temperature in sea-fish, and even in those of the greater part of the lakes and rivers, must be but small, even in those places where the surface freezes over. Water begins to freeze when it is cooled after being stationary, or about 40° in the mass; and though the surface sinks to the freezing point, and ice forms, the water below does not become colder in consequence of the ice on the top. No doubt the ice thickens at the under side in long continued frosts, and the frost is sometimes of such intensity and duration as that the whole volume of an accumulation of shallow water is frozen; but as long as any portion of the water remains liquid, it must, taken in the whole, be heated rather than cooled by the ice over it. There is some portion of heat produced in the act of freezing, and ice is a bad conductor, and must increase the heat under it, so that, as it advances downwards in a continued frost, it may be said to drive the action of the heat before it. No part of the sea, or of any lake, or river of considerable depth, freezes to the bottom in any part of the world; and thus, the fishes in the sea may be what we call very comfortable, even when the ice is over them.

It has sometimes been supposed that the fishes hibernate in the depths, at those seasons and in those places, where and when the surface of the water is covered with ice. This may be true where the whole volume of the water is, in consequence of its shallowness, cooled down to 32° , and then of course the whole mass will be frozen, and the fishes along with it. But so long as any portion of the water remains liquid, there is no more reason why the fishes should become torpid in it under an icy canopy than there is for the Esquimaux becoming torpid in their snow houses, in which they pass the winter with more glee and hilarity than they do the summer in their huts and tents.

The idea of their not getting air under the ice, which is one of the usually-alleged causes of their hybernal torpor, is equally untenable. In a small pond that has no communication with other liquid water below the ice, this may be and often is the case, but wherever there is a communication through liquid water to the sea, or any other extended surface open to the air, there will be no want of air in the liquid water, even though there should be a mile of ice over it. The very cause by means of which air gets at all mingled with the water, will mingle it with all connected water, whether it happens to be the part of the connexion which is open, or that

which is covered by ice. Indeed, if we are to suppose an inland lake, with a stream flowing from it, to be covered with ice, and also the stream covered a considerable way down, then upon the common principle of the pressure of fluids, the liquid water which is under the ice of the said lake, must become a sort of reservoir for air, and contains more than the unfrozen water with which it has a liquid communication.

There is therefore, nothing, either in the altered temperature or the absence of air, which can render it necessary for the fishes in the arctic seas to become torpid in the water, though there may be physiological causes which induce this in some, or perhaps in many of the species. As will be seen on referring to the article *EEL*, the eels of even the warmest parts of our own country pass the winter in a sort of hybernating state; but the cause is absolutely physiological: they seek shelter in the sand, for the very same reason that brings them down to the brackish water in the autumn,—namely, that the heat may bring forward the germs of their progeny.

When our common pond fishes are affected by loss of air during the frost, they do not hibernate; and it would indeed be absurd to suppose that the depriving of any animal of air could be the means of causing it to pass into any kind of sleep. Suffocation, the effect of which is too painful to sleep under till the operation has proceeded so far that the sleep is the sleep of death, is what takes place in these cases; and difference of climate can, in this respect, produce no difference in the result.

That many animals become torpid through cold, and some at moderately high temperatures, is true; and though the occurrence is, in all probability more rare, it is by no means impossible that animals may be frozen and revive again after they are thawed; but this is a subject upon which many experiments have not been made, and in those which have been made the result has been failure. It is generally said, indeed, and usually believed in America, that when fishes are taken at the holes of the ice on the St. Lawrence, during the intensity of the Canadian winter, they are instantly frozen; and that, while they are in this state they are as brittle as the ice itself. Thus far is most likely true; for even in the comparatively mild parts of this country, not only the leaves and stems of plants, but the bones of animals when not frozen, of course are much more easily broken than in mild weather. But it is added that, if the frozen fishes are put into cold water they are gradually thawed and become alive again. An account of the frozen eels carried to Moscow, will be found in the article *EEL*, and gives (if true) some countenance to the Canadian tale; but the attempt has been made to freeze fish and restore them to life again, in some parts of North America—at New York we believe—where it has failed. Hunter reduced the temperature of frogs to 31° or one degree below the point of congelation; but we believe he did not in any case freeze them, and unfrozen, a lower temperature than 31° always occasioned death. Indeed there is another reason for concluding that no animal, the blood of which contains salts, especially muriate of soda, can live to be frozen and again revive, for salts, and the salt which we have named especially, separate when the liquid in which they are dissolved is frozen; and thus the probability is that freezing would decompose the blood of a red-blooded animal. The eggs of birds

cannot bear to be frozen without destroying their vitality ; but the spawn of frogs can, and probably so can that of fishes. This influence of changes of temperature, especially cold, on fishes, is a subject well worthy of investigation both in a natural history point of view and in an economical one. It has been found a great improvement in the quality of salmon in the London market, to have them packed in ice ; but if we could freeze them alive and thaw them out as we wanted them, it would be much better. The subject, however, we cannot pursue farther.

Organs of Nutrition. In fishes, as in all vertebrated animals, these consist of a mouth, a gullet, a stomach, or an intestinal canal. The mouth is, among fishes, the only instrument which they have for catching their food ; for though there are many curious appendages to the bodies of some of them, of which the uses are little, if at all, known, it is not probable that any of them assist in the actual capture, and none of those appendages is in its structure fitted for capturing. Some of the ground fishes, the common angler, for instance, are said to make use of the filaments with which they are furnished, for the purpose of enticing other fishes within their reach ; and the *chætodon rostratus*, of the fresh waters of India, is said to be a very skilful marksfish, in shooting flies by means of drops of water. We shall give the account of this in the language of Dr. Shaw ; but we do not vouch for all the circumstances, which we suspect are rather too clever for a fish. " When," says the doctor, " it observes one of these (an insect) either hovering over the water or seated on some aquatic plant, it shoots against it from its tubular snout a drop of water, with so sure an aim as generally to lay it dead, or, at least, stupified on the surface. In shooting at a sitting insect, it is commonly observed to approach within the distance of from four to six feet before it explodes the water. When kept in a state of confinement in a large vessel of water, it is said to afford high entertainment by its dexterity in this exercise ; since, if a fly or other insect be fastened to the edge of the vessel, the fish immediately perceives it, and continues to shoot at it with such admirable skill as very rarely to miss the mark."

The mouth of fishes varies much more in size and shape than that of vertebrated animals of any other class ; generally speaking, its opening is horizontal, and across the mesial plane, with its action, or opening and shutting, in the direction of that plane ; but the *flat fish* form an exception to this, as will be more particularly explained in describing them. The lips are not often well formed, but some are firm and fleshy, and completely surround the mouth, while others are covered with plates of bony matter, which fold over each other. Lips of this description often increase the dimensions of the mouth, as they are capable of extension and folding up. Both jaws are moveable, though the chief motion is in the under one, and the gape is very wide : there are few fishes in which they are both of equal length ; sometimes the upper and sometimes the under is the largest, and in not a few instances one or both of the jaws are extensile, or capable of being projected forward beyond the length which they have in a state of repose. The teeth of fishes are exceedingly varied, and situated in all imaginable parts of the mouth, and sometimes outside that opening altogether. Among the mammalia, the number of teeth in the same species, or even in the same genus, is generally con-

stant ; but it is very different among fish. The teeth are often so numerous that it is difficult to count them, especially as they occupy so many different positions. The jaws are not exclusively employed to support these organs, as in quadrupeds ; the tongue, the palate, the throat, being often furnished with them. In the saw-fish, the teeth are inserted on each side of its flattened and projecting snout. In the genus *sparus*, the front teeth resemble those of the human species. They are provided with fangs, which are contained in alveoli. In many fishes, the teeth are formed of processes of the jaw-bones covered with enamel. Those of the shark tribe adhere merely to the gums, or, at least, to a firm cartilaginous substance which covers the jaw. They are not formed, as in the mammalia, by the addition of new layers, one within the other, but apparently in a manner resembling the formation of bone. They are at first soft and cartilaginous, and pass, by successive gradations, into a state of hardness and density not inferior to that of ivory. In the skate, the teeth consist of an assemblage of tubes, covered externally by enamel, and connected to the jaw by a softer substance, which probably sends processes or vessels into those bony tubes. The teeth of fishes are in general bent inwards, to enable them to retain their prey. As few fishes masticate, they have seldom any teeth which resemble grinders, although those which live on the harder shell-fish have teeth fitted for triturating them. In the classification of fishes, the teeth furnish several important characters, which are little liable to variation. In the shark tribe, in particular, the teeth exhibit many remarkable differences in form, sufficient, in the absence of other characters, for the discrimination of the species. The form of the teeth and their arrangements are not less various than the places on which they are situated. Generally speaking, they are individually in the form of cones, or they are hooked. If these are placed in several rows, they are sometimes called *carded teeth*, because they bear a resemblance to the teeth of the instruments used in carding wool and other matters ; if they are very small, numerous, and thickly set, they are called *velvety* (*en velours*) ; and if long and close they are called *brushes*. Sometimes, however, the individual teeth are too minute for being seen, though they may be felt as a sort of granular roughness upon the surface. In this case they are said to be *asperities*. Though the teeth of those species which feed upon *fuci*, and other vegetable products of the sea, are adapted for biting off or dividing those products, and some of the teeth of the sharks are capable of dividing and tearing in a dreadful manner, yet there is no provision in the mouth of a fish by means of which mastication or chewing can be performed. Indeed this is an operation exclusively confined to the mammalia, which accordingly are the only animals which have a grinding or a lateral motion in the jaws ; and thus all fishes are obliged to swallow their food in the same manner in which it is at first taken into the mouth. The lips, in the bony fishes especially, have no muscles by means of which they can be closed and compressed so as to assist in the act of swallowing, though they have often masses of considerable size to swallow. Instead of this they have a peculiar apparatus, to which we made some allusion when speaking of the progress of the water in breathing. Behind the front teeth, or those in the anterior part of the jaw and the vomer, there is a reduplication of

the internal lining of the mouth, which forms a sort of valve; and this valve also assists in conducting the food towards the gullet, which is also promoted by the teeth on the tongue and palate, which being reflected or bent towards the opening of the gullet, prevent any return. When it arrives at the pharynx, or posterior part of the mouth, it, in most of the species, meets with a third set of teeth on the pharyngeal bones, by means of which it is conveyed into the gullet. This canal is of very ample dimensions, not much less than the whole capacity of the mouth; so that many fishes appear internally like a sack as far down as the stomach. The gullet is abundantly furnished with muscles, the action of which furthers the progress of the food downwards; and it is possible that in many instances the process of digestion, or decomposition of the food, begins here, as it is known to do in many of the reptiles. The stomach of fishes is in general thin and membranous, differing little in its structure and appearance from the gullet. It frequently contains the remains of crustaceous animals, still retaining their form, but greatly altered in consistency. Hence naturalists have concluded, that the food is reduced by solution, and not by trituration. But in some fishes, particularly those which subsist principally on shell-fish, the stomach has thick muscular coats. Its shape is considerably different in the different species, but the characters furnished by this organ are seldom regarded. The intestinal canal varies much in the different species. In some it is straight, in others it has convolutions, but it is never so long as in most of the mammalia. In many bony fishes there are a sort of cæcal appendages to the canal; but it is in the cartilaginous fishes only; which, though by far the least perfect in the ossification of their skeletons, are the most so in the other parts of their economy. The abdominal viscera are enclosed in a membranous peritoneum, which has small openings near the vent, by which any liquid in the cavity of the body can be discharged, but none can readily be admitted. The greater number of fishes are, strictly speaking, *monostomata*, or have only one vent or opening for all sorts of discharges.

One remarkable viscus in fishes, to which there is nothing correspondent in any other of the vertebrated animals, is the air-sac, or air-bladder, which some have and some are without, and the real use of which in the economy of the animals is not known. Some notice of this curious viscus will be found in the article AIR-BAG; but we shall not enlarge upon it, as all that is known is that it cannot have the use which is commonly supposed—that of regulating the specific gravity of the fish. If this bag were to be alternately filled and emptied of air, according to the different pressures of water to which the fish was subjected at different depths, then, we must suppose that the fish must have the means of filling it. A “gas-work” in the cavity of a fish for this purpose, is not likely, and besides there is no apparatus. Neither is the air with which this muscle is filled, the refuse of that from which the oxygen apart necessary for the purposes of life, is taken in the process of respiration; for though the greater part of the contents is nitrogen, the quantity of oxygen in it increases as the fish to which it belongs is an inhabitant of deeper water. As little can it be filled from the external air when the fish is at the surface, because its contents are not the same as the atmosphere; and

also if supplies were taken in there it would hinder the descent of the fish. Besides, of fishes that have similar habits, some of them surface fishes, and others bottom or ground ones, some have this viscus, and others are without it. Thus, the only conclusion to which we can come in the present state of our knowledge is, that we are in utter ignorance as to its real use. The air-bag of fishes, when cleared of fatty matter, is perhaps the purest gelatine which is obtained from the whole animal kingdom; and as such, it is of much value both as an article of food and in the arts.

Though we do not think it necessary, in this brief outline, to give any account of those secretions of the liver, the pancreas, and other viscera of fishes, which assist in the assimilation of their food, and in other parts of their economy, and which do not appear to differ very essentially from the same precedents in other vertebrated animals; yet there is one peculiar secretion of the surface which is so peculiar, that we cannot wholly pass it over in silence. This is the secretion with which they are covered over, and which appears to be the means by which their bodies are preserved from injurious maceration by the water in which they float, and by means of which also, they are allowed to range thereon in whatever direction may be necessary.

The last of these is a matter of more consequence than they who have not been in the habit of attending to such subject would readily suppose. According to a well-known law of bodies floating in water, if that water were to wet them completely, they would have a constant tendency to come on shore; and though, in the case of a fish, this might be occasioned by perhaps not a very great deal of muscular effort, yet that effort would be a continual one, and would wear them out more than a greater effort made only at intervals. The friction of the water in the case of a wet fish, would also be a considerable disadvantage, but the grand disadvantage, however, would be the decomposition of the epidermis, and the consequent pain and destruction of the whole animal. All these bad effects are prevented by the mucous secretion.

As might be expected from their difference in other respects, the production of this mucus is not quite the same in the bony and the cartilaginous fishes. The following account of it in the skate, by the late Dr. Monro, will show how intimately it is connected with even the most important part of the system. “First,” says Dr. Monro, “I have discovered one very elegant serpentine canal between the skin and muscles, at the sides of the fine apertures into the gills. Further forwards it surrounds the nostrils; then it passes from the under to the upper part of the upper jaw, where it runs backwards as far as the eyes. From the principal part of this duct, in the under side or belly of the fish, there are not above six or eight outlets; but from the upper part near the eyes, there are upwards of thirty small ducts sent off, which open upon the surface of the skin. The liquor discharged from these has nearly the same degree of viscosity as the synovia in man. But, besides the very serpentine duct I have been describing, I have remarked on each side of the fish, a little further forwards than the fine breathing holes, a central part from which a prodigious number of ducts issues, to terminate on almost the whole surface of the skin, excepting only on the snout or upper jaw. At these

centres all the ducts are shut, and in their course they have no communication with each other. In these two central parts, or on the beginning of the mucous ducts, a pair of nerves nearly as large as the optic, terminates, and which is a curious circumstance with respect to them, they are white and opaque in their course, between the brain and their ducts, but when they divide, they become suddenly so pellucid that it is impossible to trace them further, or to distinguish them from the coats of the ducts."

In the bony fishes, the distribution of this mucous secretion is somewhat different. The orifices from which it is discharged are principally either on the forehead, or along the lateral line. This line by the way is a peculiar marking in fish. In some it is not found, as in the lamprey; in most fishes it is single; but in some, as in the launce (*ammodytes*), it is double; and there are some fishes, indeed the greater number, which have it straight; but in others it makes a singular bend upward, opposite to the cavity of the body. This line is differently coloured from every other part of the side of the fish; and its colour fades sooner after death than the colour of any other part. This, together with the accumulation of the mucous ducts upon it, shows that it must have some important connection with the living action of the fish; though what this connection is has not been ascertained. The mucus itself has not been analysed with sufficient care, but it seems to be something in the nature of albumen, probably in nearly the same state as it exists in the epidermis, though it is liquid in the one case, and solid in the other. It is indeed a substance which, though plentiful, is not very easily examined, at least in such a manner as to judge of it while the fish is living and under the water, because it seems so intimately connected with the nervous system of the fish, that there is no knowing how great a change may be produced in it by death, or even by exposure to the atmosphere.

Organs of sensation.—The senses of fishes, like those of all other animals, form a very important part of their history; and we know from various facts, that in many fishes, not only particular senses, but sensation generally must be very acute, from the readiness with which they are affected by slight changes of the weather. In a trouting stream for instance, when the sun is under a cloud, and that cloud brings, as it very often does, a slight curl upon the water, the trout will rise to the fly with the greatest readiness; and also be seen sporting about in all directions near the surface; but as soon as the cloud passes, and the ripple along with it, not a trout will rise to the most skilful angler; and one may observe them lying perfectly still near the bottom of the shallows. Under those circumstances there can be little difference of temperature in the water, for the two may succeed each other several times in the course of a few hours, and therefore the trout must be in some way sensible to the influence of light. The same species of fish, and many others, are also remarkable for the acuteness of their vision. Every angler in clear streams knows how vain it is to tempt a trout, if either his shadow or his reflection is thrown upon the water; and even if the angler is on the right side, the passage of a countryman along the opposite bank, or a cow coming to drink, may spoil his sport for the day. Of the hearing of fishes we know less; but we do know that water is a conductor of sound in a pecu-

liar way, though, as we cannot make our experiments on a direct parallel, our own ears being of a different structure from those of fishes, we can arrive at no very conclusive result on the subject. As to the sense of smelling, though some have gone so far as to say that a trout knows a living worm from a dead one by the smell, yet as the same sense does not enable the very same trout to distinguish an artificial fly with a hook in it, from a real fly upon the water, we must conclude that this sense is exceedingly imperfect. Of taste fishes can have but little, and indeed no animals but such as masticate their food, or at all events have soft tongues, have this sense in any high degree. But fishes, at least with very few exceptions, swallow indiscriminately almost any substance which is floating; and sailors sometimes amuse themselves with "giving a shark his grog," as they term it, that is throwing a corked empty bottle overboard, in order that a shark may swallow it.

The brain in fishes, if we are to suppose that the acuteness of sensation bears any proportion to the development of that organ, is very small and very soft. In the tunny it is less than one seventeen thousandth part of the body; and in carp, which have it in a greater proportion than most of the species that have been examined, it is less than the five-hundredth part. The peculiar manner in which the brain of the whole finny race is developed, or rather the portions of it which have the greatest development, would lead us to conclude that, if we are to connect the faculties and propensities of the animal with this organ, the chief propensities of fishes are those that relate to mere feeding and motion.

Of the peculiar organs of sense, the eye is the most conspicuous, and in all probability the most useful to the animal. As is the case with all vertebrated animals, fishes have only two eyes, placed, generally speaking, in opposite sides of the mesial plane. The flat fish no doubt form an apparent exception to this; for in the usual way of regarding the darker coloured side as the back, and the lighter coloured one as the belly, the eyes are always on the upper or back part, and towards one side of the mouth, sometimes the left side, and in other species the right, as will be mentioned in the article *FLAT-FISH*. But this apparent deviation from the typical, and indeed the invariable position of the eyes in vertebrated animals, is not real in the fishes under notice. There is a twist in the neck, or at all events in the upper portion of the spinal column, which turns the mesial plane in an oblique direction; so that when it passes from fin to fin in the body of a flounder, it passes through the head in a curve, from a point between the eyes through the mouth to the middle of the lower jaw. In their size the eyes of fishes vary considerably; and though the general law be that the eye is large in proportion as the fish inhabits the deeper water, yet there are some exceptions. Thus in some species of eel the eyes are so very minute, that they are barely visible, even in a tolerably large specimen. But the exception here is also more apparent than real; for though those eels do inhabit the bottom of those waters in which they are found, yet they are never found at any great depth. Besides, eels live partly in the water, and partly in the mud, being as it were a sort of water moles; and therefore like the moles which burrow in the ground, and almost all animals which enter partly or wholly into the soil, they have less need of large eyes, and such eyes would be much more liable

to injuries. We may therefore consider it as a general law that where fishes inhabit the water, and do not bury themselves at least over the eyes in the ooze at the bottom, the size of the eye is in proportion to the depth. Thirty or forty fathoms may perhaps be considered as the average depth of a cod fish on the ground banks; and the eye of a fish of this description is at least as large as that of an ox. Thus the size of the eye guides us to the position which the fish holds in the water; and in like manner the situation of the eyes points out in what direction the fish looks out for its food. Those which lie at the bottom, or swim near the bottom, and look for prey over them, have the eyes in the upper part of the head, and often very near to each other; and in order to answer this habit, the mouth of such fishes very generally opens upwards also,—that is to say, the lower jaw projects beyond the upper one, and rises up in front of it. On the other hand, if the fish has to seek its food below it, the eyes are placed wide apart, and fishes of this kind very frequently have the muzzle or frontal line from the eyes sloping downwards as if truncated, and the opening of the mouth below. Fishes which follow their prey in level chase, have the eyes placed more nearly in the situation of those of land animals of the chase; and in them, whatever may be the nature of the prey, the opening of the mouth is pretty nearly straight.

This connection between the form and position of the eyes, and the mouth of fishes, and also with the depths at which they feed, and the direction in which their food is situated with regard to them, is very important in the natural history of fishes, and affords perhaps a surer guide to the character of any “strange fish” that we meet with, than half the characters which are given, or which can be given in the systems. Indeed, systematic ichthyology is very imperfect in this respect; for even where the characters of the genus, the species, or even the larger division, are given with the greatest accuracy, they do not of themselves give the slightest indication of the part of the sea in which we are to seek for that species of fish with the greatest certainty of success; and it would certainly be desirable to combine something of this kind with the systematic view, though to carry it into details would most likely be a work of immense labour and much uncertainty. It would also be a good plan, if the execution of it were possible, to connect the qualities of the fish as food, with the characters indicating the depths at which they are found; but this is a point to which we shall have occasion to recur.

The eyes of fishes are placed in *fossæ* or sockets in the bones of the head, much in the same way as those of the other vertebrated animals; but they are in general destitute of eye-lids, neither have they any projecting arch in the form of an eyebrow, or any of that apparatus which in the land vertebrata is employed in lubricating and cleaning the eyes. Whether fishes know sorrow we cannot tell; but we are sure that they cannot “weep over their woes,” for they have no tears. In the moon fish (*Tetrodon mola*) however, the eye is in great part covered by a circular lid, which has merely a perforation in the middle for admitting the light. In the greater number the skin passes over the eye without any division, so that that organ is as well defended as any other part of the body, only the skin over it is transparent. In removing the skin from a common eel, there is no perforation answering to the eyes. The whole skin appears of

equal strength, only there are two little patches corresponding to the eyes, which are transparent and colourless.

But in some fishes there is not this transparent spot, or window for the accommodation of the eye. In some the texture, and even the colour, of the rest of the skin extends to the part which covers this organ. In the trunk fishes (*Ostracions*) there are the same striæ or rugosities in the skin over the eyes, as in that of the surrounding parts; and in that singular inhabitant of the northern seas (*Gastrobranchus cæcus*, *Myxine glutinosa* of Linnæus,) the common integuments which pass over the eyes are so exactly of the same colour and texture as the rest, that the animal appears to have no eyes at all until the skin is removed.

The element in which fishes live, by the constant motion of the water, renders the use of eyelids and lubricating fluids perfectly unnecessary; and their exposure to the same fluid under a heavy pressure, owing to the great depth, requires a far more firm covering than the common coat which encloses the aqueous humour of an eye which is used only in the air. A projecting eye, or one convex outwards, would be equally inconvenient, and thus the surface of the eyes in fishes is flat; but this is compensated by the greater magnifying power of the crystalline lens. The flat cornea of the eye in fishes, besides being that which sustains least injury from the passage of the fish through the water, and from the chance of striking against obstacles, has some advantages in the greater quantity of light which it sends to the sentient part of the eyes, than would be sent by a convex surface. It is only at the middle of such a surface that the whole of the light falling upon it enters; for everywhere else a portion is reflected off, corresponding to the angle at which the circular surface turns away from a plane at right angles to the axis of its centre; and by this means, great part of the light which falls upon the external surface of a very round or protuberant eye, is dispersed through the surrounding atmosphere, and would be lost for all useful purposes in vision. But when the surface of the eye is flat, as it is in fishes, there is no more light reflected away from one part of it than from another; and therefore, of such quantity of light as may reach the eyes of fishes in the depths of the sea, there is much less lost than there is of that which falls upon the convex eyes of land animals. No doubt there is a much more scanty supply of light under the water, especially at considerable depths, than there is upon the land; but it is this which, more than any thing else, shows the beautiful adaptation of the eye to the circumstances under which it is used; and no one who reflects on the subject will fail to perceive that in the coincidence of this with all the other advantages which the fish derives from the peculiar structure of this organ, there is evidence of wisdom far surpassing not only the wisdom of man, but the estimation of the human mind, in any other feeling than that of simple adoration.

In fishes the general form of the entire eye with its coats, its lenses, and its humours is nearly that of a hemisphere, of which the flat side is external, and the interior one spherical. In the skate, the superior part is also flattened, so that the vertical diameter is to the transverse as one to two. This flatness of the anterior part of the eye is compensated by the spherical form of the crystalline lens. This body is

more dense in fishes than in land animals. Monro found the crystalline lens of an ox to be 1104, while that of a cod was 1165, water being reckoned at 1000. The crystalline lens projects through the pupil, and leaves scarce any space for the aqueous humour. The vitreous humour is proportionally small. The portion of the axis occupied by each of the three humours of the eye, in the herring for instance, may be expressed in fractions as follows: aqueous humour $\frac{1}{7}$, crystalline lens $\frac{2}{7}$, and the vitreous humour $\frac{4}{7}$. The spherical form of the crystalline lens has been already alluded to; but the following table, from the observations of Petit and Cuvier, will exhibit more clearly the proportion between the axis and the diameter in a few species.

The axis to the diameter in the—

Salmon as	. 9 to 10	Whiting	. 14 to 15
Sword-fish	. 25 26	Shark	. . 21 22
Shad	. . . 10 11	Ray	. . . 21 22
Pike	. . . 14 15	Herring	. . 10 11
Barbel	. . . 11 12	Tench	. . 7 8
Carp	. . . 14 15	Eel	. . . 11 12
Mackerel	. . 12 13	Conger	. . 9 10

In the eyes of fishes the sclerotic coat is firmer than it is either in mammalia or in birds. It is here cartilaginous, semi-transparent, and elastic, and sufficiently solid to preserve its form of itself. In the salmon it is of the thickness of a line posteriorly, and of an almost bony hardness before. This is frequently the case in other fishes, especially near its junction with the cornea, where it sometimes appears like an osseous ring. The outer layer of the choroid coat is either white, silvery, or gold-coloured, and is very thin and a little vascular. The inner coat, to which the term *membrana ruyschiana* has been applied, is in general black, and covered every where by mucous substance. In the ray, however, it is transparent. Between these two membranes of the choroid coat there is a body of a brilliant red colour. Its form is usually that of a cylinder, formed like a ring round the optic nerve; the ring, however, is not complete, a segment of a certain length being always wanting. Sometimes, as in the *Perca labrax*, it consists of two pieces, one on each side the optic nerve. It is considered by some as muscular, and enabling the eye to accommodate the figure to the distance of the objects; while others regard it as glandular, and destined to secrete some of the humours of the eye. This gland, we may add, does not exist in the *Chondropterygii*, as for instance in the rays and sharks. In the eyes of fishes the iris has generally a rich metallic lustre, usually of a golden or silvery tint. This is occasioned by its transparency, which allows the natural colour of the choroid or painted coat to be seen through it. In different species the pupil or opening of the iris differs in shape; but, generally speaking, it is either a circle or an oval. In the salmon, and in some other genera, however, it is drawn out into a sharp angle at the fore part; but what may be the use or effect upon fishes of those differences in the form of the pupil, we have no means of ascertaining, inasmuch as we cannot refer them to certain habits of the animals, as we can in the case of those mammalia which have the pupil contracting in an oval form upon an axis either vertical or horizontal. There is one species of fish, *Anableps tetraphthalmus*, which has a very peculiar formation of the eyes. This fish has in reality only two eyes, but there is a double pupil to each, which gives it the appearance of having four. See the article ANABLEPS.

In the skate the upper edge of the pupil is formed into several stripes arranged like radii of a circle, of a golden colour on their external surface, but black on the internal one. In ordinary states of the eye they are folded back and concealed between the upper margin of the pupil and the vitreous humour; but if pressure is applied to the upper part of the eye, they unfold and come partially over the pupil like the blind of a window. In the torpedo or cramp fish there is a veil of this kind which is capable of entirely covering the eye. Of the bony fishes, and indeed of most of the cartilaginous ones, none possess an apparatus of this kind, though in most fishes there is a vertical veil at the corner of the orbit which covers a small portion of the eye. The eyes of fishes are, generally speaking, supported on a mass of elastic jelly-like matter, which acts as a spring, and prevents them from receiving any concussion even in the most violent motions of the fishes. But in the cartilaginous fishes the support of the eye is quite different from this. In them the eye is placed on one end of an elastic peduncle or stalk of cartilaginous substance, which has its other extremity inserted in the bottom of the orbit, and the muscles, by acting on the eye placed on this flexible peduncle, can give it extensive motion in every direction, while, when the muscles cease to act, the elasticity of the peduncle brings the eye back to the mean position. Fishes which have eyes of this description are generally very voracious in their dispositions, and this mobility of the eye gives them great command of all the space around them.

We have occupied so much space in describing the eyes of fishes, that we can spare but little to their other organs of sense; but, in respect of them less is necessary,—first, because they are much less perfect, and the fish appear to depend less upon them for information and guidance; and, secondly, because we do not know how ears and olfactory apparatus may act under the surface of water. Sound, as we hear it, is heard by peculiar pulsations of the air; and scent, we have reason to believe, is occasioned by particles of the odorous body which diffuse themselves through the air, and though we often experience scents emitted by the air to the water, we know not what may be the effect of similar successions under the surface. When an odorous substance is floating in a running stream, we have no reason to suppose that any particles capable of affecting organs of smell can be given out by it against the current; and if we may reason from analogy, in a case where we can reason from nothing else, we must be led to conclude that such emanations can make their way through the water only to very short distances, so that in an ample body of water it does not appear that there can be much scent.

Then, in the great body of the oceanic waters, which is the grand habitat of the fish—a field which man has not either to plough or to sow, but from which he may nevertheless reap, and does reap when even moderately industrious, a most abundant harvest—there are other causes capable of destroying all odorous matter. The sea contains a vast quantity of chlorides, or at all events of hydrochlorides, substances most destructive of the effluvia, especially the noxious effluvia, of bodies in the air, and thus we may consider the sea as the grand laver of purification for the globe, and this fact is against the existence of much sense of smell in fishes.

In the case of sight, the state of things is very different, and fishes may, especially from the microscopic form of the crystalline lenses of their eyes, have as perfect vision at depths to which we suppose only a small portion of the light of the sun ever reaches, as we have in the noontide beams of the luminary. We must not judge of the capacity of any eye for seeing under water, from the difficulty that one has of seeing into it; because, without any reference to the clear or muddy state of the water itself, the quantity of light which the surface reflects when the rays fall obliquely upon it, is greater than that which is not out of the water. Of this we have a case nearly parallel, when we stand in a very oblique position with regard to a window, and endeavour to see what is going on inside. The glass of the window may be nearly as transparent as the air itself, and it may be perfectly flat, so as not to break the reflected light; but the more transparent, and the more flat and smooth, the more completely does it obstruct our vision by the reflected light, if our position has the requisite degree of obliquity. But notwithstanding our inability to see through the window into the apartment under these circumstances, the people in the apartment may be enjoying even a quantity of light which is painful to them, and they may be capable of discovering the most minute object, not only inside the room but through the window.

The situation of fishes in the sea is much the same as that of the inmates of the room in this illustration, and we, the observers of the fishes, are like the spectators out of doors, incapable of seeing what goes on, either if our position is oblique, or if the light falls obliquely on the surface. And we have the evidence of direct observation in proof of this. There is no reason why the water of the sea should be more transparent in the regions of the equator than in those of the poles; and yet, from the mere fact of the solar light falling nearly perpendicular upon the surface of the water in those seas, they are as clear as crystal, and one can see the whole of the operations that are going on even though the depth be forty fathoms or more. In our latitudes we can see but a very small depth into the sea, and therefore the operations which go on under the surface are a sealed book to us. But it is only we who are thus left in the dark, for there is abundant light for every eye which is under the water. Those who have so practised diving that they can do it with the eyes open, are able to see the smallest object at the greatest depths which they can reach; and there is no doubt that, from the peculiar structure of the eye in fishes, and the increase of the field of view in proportion to the depth, they can see the most minute objects at the greatest depths which they inhabit, and that, at all depths, sight is the sense on which they chiefly depend. Still fishes have organs both of smell and of hearing, and without a slight notice of these our sketch of them would be incomplete.

The organs of smell vary more than in the mammalia or birds. In many, the nostrils have only the opening on each side; but in others, this is parted by a septum which gives them the appearance of having four nostrils. Sometimes the openings are round, sometimes oval, and sometimes they are longitudinal slits. They are either on the mouth or between the eyes, or in an intermediate position; and they have occasionally the form of short projecting tubes. They are furnished with a few muscular fibres, and so must

be capable of some motion; but to what extent, and for what purpose, it is by no means easy to determine.

On examining the inside of the nostril, we find in sharks and rays a large lamina, which extends the whole length of the opening, with smaller parallel laminae branching off from it on each side like the teeth of a crab; while in most fishes of both divisions these laminae are like rays with a tubercle in the centre. In the membrane which lines the nostrils of the pike, the vessels are black; but in most fishes they are red; and there are between the nasal vessels in all fishes, papillae which discharge a thick mucus. The olfactory nerves, at their origin, form swellings or knots, so large as frequently to have been mistaken for the real brain. These tubercles in skates and sharks are united into one homogeneous medullary mass, from each of the lateral parts of which the olfactory nerves arise. In the flounder, the herring, pike, perch, and salmon, there are two pair of tubercles, the anterior of which is smaller than the other. In the cartilaginous fishes, as the skates and shark, the olfactory nerve is very soft. It is, in them, a bulb which passes obliquely forward towards the nares, which are at a greater or less distance from the brain, according to the species. The spinous fishes have the olfactory nerve very long and slender. In those which have the snout elongated, this nerve is received into a cartilaginous tube. In those with short snouts, the nerve is surrounded by a fine membrane only, which appears to be the same as that which contains the fat or oily humour that covers the brain. In the haddock, and some other fishes, the olfactory nerve, in its course from the brain to the nose, passes through a cineritious ball, which resembles the cineritious matter connected in our body to the olfactory nerve within the cranium. When the olfactory nerve arrives behind the folded membrane which we have described, it is dilated to be applied to the whole of its internal and convex surface. In some fishes no previous enlargement takes place; while in others the nerve swells into a real ganglion. When expanded, it has been compared to the retina, but the filaments of which it is composed are more distinct.

As a specimen of the opinions which are held by those who speak and write with not the most profound reflection, but which sort of opinions are unfortunately the most prevalent both in conversation and in books, we shall quote a short passage from Dr. Shaw's General Zoology, which, however, the reader, who bears in mind the readiness with which artificial flies and wooden minnows are taken, will perceive, carries its own refutation. "If," says Dr. Shaw, "you throw a fresh worm into the water, a fish shall distinguish it at a considerable distance; and that this is not done by the eye is plain from observing, that after the same worm has been a considerable time in the water, and lost its smell, no fishes will come near it; but if you take out the bait, and make several incisions into it, so as to let out more of the odoriferous effluvia, it shall have the same effect as formerly. Now it is certain, that, had the animals discovered this bait with their eyes, they would have come equally to it in both cases. In consequence of this smell being the principal means they have of discovering their food, we may frequently observe them allowing themselves to be carried down with the stream, that they may ascend again leisurely against the current of water; thus the odoriferous particles swimming in that

medium, being applied more forcibly to their organs of smell, produce a stronger sensation."

But though we have very little ground for supposing that there is any application of the olfactory nerves of fish which bears much analogy to the sense of smell in animals which live in the air, yet this apparatus is so elaborate, and so constant to its form in the different genera and even species, that it would be very desirable to know more about its use. Not only on account of the light which it would throw upon the physiology of fishes, but because the difference in this apparatus might be made good and permanent systematic characters. That this apparatus is of very little use, either in directing fishes where to find their food, or how to select it, is highly probable; and, therefore, in the present state of our knowledge, or rather, we should say, perhaps, of our ignorance, the most rational conclusion is, that those nostrils, which, from their structure and the nature of their internal coating, must be very sensitive in some way or other, teach the fish to avoid water mixed with substances which would be deleterious to its health. In man, and in all those animals which have soft tongues and breathe through the nostrils, there is a very close connection between the senses of smell and taste, especially when the taste is that of an aroma, which affects the palate rather than the tongue, as is proved by the fact, that if a substance having this aroma is taken into the mouth, and the nostrils held closed, it is not only impossible to tell what aroma it is, but there is little or no perception of aroma at all.

Though the vulgar opinion often is, that fishes do not hear, the contrary is established by many facts. Pond fishes, such as trout and carp, have been trained to come regularly and be fed at the ringing of a dinner bell, while others have answered to a whistle. It is reported that the Romans, among whom pet fishes were very common in the days of their greatest luxury, could call any one fish by name, and the fish would answer. Perhaps this is going a little too far; but from the observations which have been made in modern times, it is certain that fishes not only hear, but hear very readily; and there are some other circumstances which would lead one to conclude that they are susceptible of a good deal of education, and capable of showing considerable attachment. In showery weather, river fishes will often be seen feeding and moving about with the greatest activity, and biting as freely as the most devoted angler could desire; but if there comes a loud peal of thunder, down goes every fish to the bottom, and the sport is over for some time. So also the discharge of artillery, or muskets, or shouting scares the fish; and, therefore, fishermen are usually silent when shooting their nets.

In the bony fishes, and also in the cartilaginous ones, which have the gills free, there are no external openings of the ears; but in those fishes which have fixed gills, there are in the occiput two small openings, sufficient to admit the head of a pin, which lead to the internal ears. In fishes having the gills free, the internal organs of hearing are situated in the sides of the cavity of the cranium, and fixed there by a cellular tissue, consisting of vessels and bony or cartilaginous bridges. In fishes with the gills fixed, those organs are enclosed in a particular cavity formed in the substance of the head. This cavity is situated on the side and posterior part of that which contains the brain, with which it does not communi-

cate, except by the holes that afford passages for the nerves. The sac exhibits many differences as to size and form in the different species. Besides the ordinary viscid fluid, there are some small cretaceous or chalky bodies suspended by a fine nervous tissue. In the osseous fishes these are three in number, and are white and hard, like porcelain. In the cartilaginous fishes with the gills free, these bodies are less numerous, and their consistency is seldom greater than that of moistened starch. The use of this peculiar part of the auditory organs is not very well known; but it is supposed that they communicate to the nerves the vibrations of the water. As the ears of fishes are much more simple in their whole structure, than those of land animals, and as the parts of which they are composed are not easily examined with sufficient accuracy, they cannot well be made grounds of systematic arrangement.

Reproduction of Fishes—This, though one of the most general and energetic of all natural operations, is involved in very considerable obscurity; and human art has not been applied to the increase of the numbers or the improvement of breeds; and, indeed, from the rapidity with which all fishes multiply, this does not appear to be absolutely necessary. Fishes are, generally speaking, either oviparous, or producers of eggs which are brought to maturity external of the body of the mother, or they are ovoviviparous, that is, producing the eggs in one part of the body, and bringing them to maturity in another, discharging the young alive. In most fishes the two sexes are distinct, and in different individuals; but in some few instances, it is alleged that they are true hermaphrodites, or have both sexual energies in the same individuals. This is, however, an obscure part of the subject, liable to many uncertainties; and, therefore, we shall not enter into any of its details. Leaving them out of the question, we have the two divisions of oviparous and ovoviviparous, or, as they may be more popularly termed, fishes which are hatched externally of the mother, and fishes which are hatched internally.

Of the first, which is by far the most numerous division, and also the most prolific, the whole have free gills, though some of them are bony, and others cartilaginous in the skeleton. The female organs, which are popularly designated roes, are generally double, but sometimes single; and the corresponding organs of the males, which are properly called milts or whites, are of pretty similar form, though of very different consistency. The roe consists of a vast mass of eggs contained in an apparently very thin membrane, which are at first small, but gradually increase, and are large and very distinct at the time when they are excluded from the body. The milt contains a thickish fluid, which merely increases in quantity, so as to arrive at its greatest bulk when the ova or eggs of the female are in a condition for being deposited.

It is for the purpose of bringing this substance to maturity, that so many fishes seek the warmer parts of the waters at certain seasons of the year; and it is for the purpose of depositing their spawn, that the greater number of our shoaling fishes, which are at other times in the deep water, or discursive through the seas, come upon the coasts. The places to which various species of fishes resort for these purposes, the mode in which the eggs and milts, or spawn as the two jointly are called, are deposited, and the substances to which they are attached for the purposes of stability or protection, are, however, so numerous, that it is impos-

sible to generalise them. In general the approach toward the shore of fishes for the purpose of spawning, is an operation of the greatest possible value to man. At the time when the roes and milts are coming to maturity, all the energies of the fish appear to be excited to a more than ordinary degree; so that at this time, and up almost to the period when the spawn is ripe for being deposited, the fish are in the best condition for the table; and thus they may be said to come on the shores almost on purpose to be caught. The eggs of different fishes vary much in colour; but those of all the species in the present division, agree in being perfectly globular. None of them have shells, but they are enveloped in a membranous integument. This integument is more or less firm according to the species. The yolk, instead of occupying the centre, as in the eggs of birds, is placed laterally, and is surrounded by the glaire or albuminous matter. Between the yolk and the glaire is situated the germ or embryo. The germ becomes ready for exclusion at very different periods, according to the species. Thus the egg of the carp is said to be perfected in the course of three weeks, while that of the salmon requires as many months. But in the eggs of the same species, a great deal depends on the temperature to which they are exposed. In the same pond, those eggs are soonest hatched which have been deposited in the shallowest water. As the embryo is developed, the heart first appears, afterwards the spine, eyes, and tail. The organs of motion are evolved in the following order. The pectoral fins first make their appearance, and afterwards those of the tail; the dorsal fins follow, and then the ventral and anal fins. In fishes, such as the salmon, which bury their spawn under the gravel of rivers and brooks, the appearance of the young at first is very singular, as they come up through the covering, while the lower part of the body remains attached to the remainder of the egg below.

In fishes which hatch their young, the eggs are fecundated internally; but observations have been made on comparatively few fishes of this division, and therefore our information respecting them is comparatively vague. The sharks and rays are the ones to which most attention has been paid; and the following remarks will show in outline the progress of the young in these. The females have two ovaries, or egg vessels, situated at the sides of the spine, and containing eggs in different stages of forwardness. An oviduct proceeds from each of these, the anterior extremities of which are united to the diaphragm and spine. Internally, these ducts are covered with glandular papillæ, and pass through a large glandular body. After passing this body, they dilate into a large sac. When the ova pass into the oviduct they are carried to this glandular body, which is supposed to secrete the glaire or albuminous part, and afterwards conveyed to the uterus, where they receive the shell. At what period the egg becomes impregnated, or in what manner the operation is performed, are questions to which no satisfactory answers can be returned. The eggs are of a quadrangular form, with processes at the four corners; they are called sea mice by some, but by fishermen they are called skate-purse, or shark-purse. The shell has a horny consistence, and may often be observed, at certain seasons, among the rejectamenta which the sea casts, as being no longer useful in its economy. When the young fish have been perfected in the uterus, where they derive

their nourishment exclusively from the egg, and not from the mother, they are ejected through the openings of each uterus, at the sides of the cloaca, and upon escaping from the shell, enjoy immediately an independent existence, and begin to search after new nourishment.

The individual broods, or shoals of production, in fishes of this description, are not nearly so numerous as those of the oviparous fishes, though from the different stages of growth, at which the eggs are contemporaneously found in the females, it is probable that the period of production lasts considerably longer. Such fishes have not the same necessity for migrating in search of proper breeding grounds as the others, and therefore the whole sea is comparatively free to them at all times in proportion to their habits. It farther appears that they are not so much exhausted by the labour of reproduction, and thus their flesh does not get so much out of season as that of the others. This may also, in conjunction with the softness of the bones, which never know old age (see *CHONDROPTERYGII*), contribute to the large size, inexhaustible strength, and long life of these fishes.

In the sea, it does not appear that there are any hybrids among fishes, any more than there are among land animals in a state of wild nature; but the case is said to be different in ponds, in which carp and trout are sometimes said to blend their several qualities. This point, though one of some interest if fish were cultivated as they ought to be, is one which is involved in very considerable obscurity.

The following table, the result of useful observations which are extracted from the Philosophical Transactions for 1767, will give some idea of the relative fertility of several species of oviparous fishes:—

Fish.	Weight.		Wgt. roe.	No. of eggs.	Date.
	oz.	dr.	gr.		
Carp . .	25	5	2,571	263,109	.. April 4.
Codfish .	0	0	12,540	3,686,760	.. Dec. 23.
Flounder	24	4	2,200	1,357,400	.. March 14.
Herring .	5	10	480	36,960	.. Oct. 25.
Mackerel	18	0	1,223	546,681	.. June 18.
Perch . .	8	9	765	28,323	.. April 5.
Pike . .	56	4	5,100	49,304	.. — 25.
Roach . .	10	6½	361	81,586	.. May 2.
Smelt . .	2	0	149	38,278	.. March 21.
Sole . .	14	8	5,422	100,362	.. June 13.
Tench . .	40	0	—	383,252	.. May 28.

From this table it appears that there is no constant proportion between the weight of the fish and the number of eggs, or the weight of the roe. We have also no means of ascertaining any thing with respect to the relation between the size of the present fish and that of their progeny; as, for instance, we are unable to tell whether the fry that are produced from the roe of a small fish, are equal to, or greater or less than those produced by the roe of a larger fish of the same species, or the same age. We have also no means of ascertaining what proportion there may be between the eggs that are deposited and the number of fish that are hatched, and between the number that come to maturity. The eggs are eagerly sought after by other fishes, by aquatic birds and reptiles. In the young state, they are pursued even by their own species, as well as by beings belonging to other classes. But for the numbers of eggs thus produced, the very race of fishes would soon be extinguished by enemies while young; and we may add, that the diminution of the number of eggs would cut off a large supply of food, and destroy that dependence which

we observe in the system of nature, of the different races of animals on one another. The season at which fish deposit their eggs varies according to the species, and even the habits of the individual. It is well-known that among salmon, even in the same river, a difference of some months is observable, and we believe that the same remark is applicable to all other kinds of fish. In general, before spawning, fish forsake the deep water, and approach the shore, that the roe being placed in shallow water the influence of the solar rays may vivify it. At that season some fish forsake the salt water and ascend rivers; and, after spawning, retreat again to the ocean. The eggs of various species of fish belonging to the oviparous order, with distinct sexes, are used as articles of food. Where circumstances permit, they are consumed while in a recent state. In other situations they are salted, and form the well-known article of trade called caviar. The characters which the organs of reproduction furnish in the discrimination of species have been hitherto too much neglected. Connected as they are with the existence of the animal, and exercising a powerful controul over its habits, they ought to be examined with care, and their appearances recorded in detail. In the case of those fishes which are ovoviviparous, and range over the wide seas, not requiring to come to the shallow water for the purpose of depositing their eggs, this might be a matter of considerable difficulty, but much more might be recorded than has been done in the case of the spawning fishes; and they are not only the most numerous, but, in an economical point of view, by far the most valuable of the whole. We must, however, pay some little attention to another branch of the general subject.

DISTRIBUTION AND MIGRATION OF FISHES. These are subjects which cannot well be separated from each other by any analogies of the facts which we are capable of forming; and the observed facts are so few, and the connexion of them is so broken, that this is a portion of the subject upon which it behoves us to express ourselves with the greatest diffidence.

In order fully to see the causes of the distribution of fishes over the wide expanse of the sea in breadth, and through the depths of its waters in profundity, there are many elements required on which our information is very limited. We know that in the tropical waters the elements of life reach to a greater depth below the surface than they do in higher latitudes; and if there be any portion round either pole or poles, which is never clear of ice, we may presume that the number of fishes there is comparatively limited both in species and in individuals. Indeed, from all that we know of the matter, we may suppose that there is in the wide ocean of every latitude a depth beyond which no creature can live; and that, consequently, before such profound depths are reached, there must cease to be any fishes. But what this particular depth may be for any one latitude we have no certain means of ascertaining; because it must depend upon several circumstances, such as the solar action, in respect of latitude, the set of any current which may happen to pass over it, and the character of the bottom; not merely as respects the soil, or other substance of which it is composed, but as respects the action which may be going on under it. Thus, for instance, if a sea is in the vicinity of volcanoes, and especially if it is studded with volcanic islands, and subject to the production of new ones, there is no doubt that the water must be warmer, and also more subject to be put in motion in such a sea, than in one below which no

such sources of heat are in operation. Thus, for instance, there is no doubt that the Mediterranean, toward Sicily and the shores of Naples, is in some respects analogous to a seething pot; and the same may be said of the volcanic portion of the Red Sea; of the sea around some of the Atlantic islands; and, in short, of that around every land where there is volcanic action in the neighbourhood of the sea. If we could go minutely into this subject, which, however, is impossible from the want of the requisite data, we should find that the progressive history of fishes, and the progressive history of volcanic action, have a very close connection with each other. In former times, when the waters of the Mediterranean covered what are now the plains of Languedoc, and many of the summits of the central mountains of France were blazing with volcanic fires, a temperature equal to that at present under the equator may have been given to the waters of the Mediterranean; and this may have been the reason why, in the accumulations of fossil fishes, which are so remarkably plentiful in some parts of Italy, there are many species of which there are no types except in the tropical seas; and those shells and other productions of the waters, which are found in the Mediterranean, of more tropical character than anywhere else, under the same parallel of latitude, may perhaps be received as evidences of the same fact. We mention these few particulars, not with any intention of entering upon the investigation of a subject of such difficulty and uncertainty; but merely for the purpose of showing that if the history of the finny tribes could be properly worked out, it would throw much more light upon many of the most interesting points in geology than we at first would be apt to suppose.

In considering the distribution of fish, the first distinction, and the most obvious one which we are required to make, is that of fresh water and salt water fishes. That there is any permanent structural adaptation to any of these kinds of water rather than the other is rendered doubtful by the fact of some fishes living by turns in the one and in the other, and apparently keeping their health equally well in both. We cannot adduce a more striking or more interesting instance of this than that of the salmon, with which every one is so familiar in our own country. Yet even in the salmon, the transition from the one kind of water to the other must not be immediate, otherwise the fish cannot live; for a salmon which has been habituated to fresh water, will die of suffocation if instantly put in sea water; and a sea salmon will do the same if instantly put in fresh water. When, however, the transition is made gradually enough, the fish not only sustains no injury, but it appears, and is indeed, evidently part of the economy of its nature to make this transition. Not only this, but we believe, in some instances, fishes which are never naturally found in fresh water, but always in the sea, and that at considerable depths, have been brought to live in water scarcely, if at all, impregnated with salt.

The next distinction of fishes, with regard to locality, is into *littoral* and *pelagic*, or those which frequent the shores and shallows only, and those which are discursive through the broad waters. The most remarkable distinction between these is, that the fishes of the shores and banks, like the mammalia of the savannahs or meadows upon land, are generally gregarious or found in extensive shoals, while the others have much less propensity to congregate in

numbers. It has been supposed by some, that when coast fishes entirely disappear both from the shores and from the surface of the water, they retire to a considerable depth, and remain there in a state of inaction; but the evidence in favour of this is far from complete, and the analogy is rather against it. If ever so numerous a shoal from the coasts were to spread themselves over the whole surface of one of the wide seas, it is quite evident that they might be so far asunder as that a ship on its passage might not observe one of them except by accident. The migrations of those fishes used to be very much misrepresented, especially in the case of herrings and some others, which were alleged to breed in countless numbers in the regions of the poles, and to come annually thence, for no reason that could well be explained, except as a bonus to the fishermen of more southerly latitudes. We know that when those fishes, whether herring, pilchard, mackerel, or any other which appear thus periodically, the milts and roes are in a progressive state; that as they remain these advance to maturity; and that if the attempt to catch them is too long protracted, they are found to have shed their spawn, or to be in the condition of what is called "shotten herrings," which are empty, lean, and unwholesome. The same applies to every other species of periodical fish with which we are acquainted. The probability, therefore, is that such fishes have little migration in latitude with the seasons, or rather that they have none at all; but that, if it be their habit to feed in the clear waters, and not on the banks as ground fishes, they make their way as the spawning season approaches for the nearest shore, if it happens to be adapted for their purpose. In proof of this, it may be remarked that they do not remain off the points, or hang in the currents, as if they were seeking the substances with which the latter are loaded, but that they frequent the estuaries, the bays, and other shallow indentations of the coasts, where the spawn which they deposit may remain undisturbed. In addition to this, we have the further proof of the countless myriads of the fry, or "soil" as it is called in the case of herrings, which is observed on many parts of our shores in the early part of summer, and which is sometimes overcome by violent action of the weather, and stranded in a close and extended stratum along the beach. This takes place on many parts of the coast where there are none of the fishes in the mature state, or at least where they are not generally fished for; and this proves that though these fishes may accumulate in such numbers as to make the capture of them a profitable trade at particular points only, yet that they contrive to range a great way in line along the coast for the purpose of spawning, but that, as is the habit with most animals, they perform this operation during the night, or at all events at times when they are not observed.

Whether, after these fishes have left the coast and dispersed themselves through the sea, it would be worth while to fish the depths for such of them as are net fishes, is doubtful; but it is highly probable that, whether their numbers would repay the labour and expense of their capture or not, yet they may be found at all times and at all seasons in those seas on whose shores they spawn, if sought for at a sufficient distance from the land. It is also doubtful whether the same fish spawns annually, or requires two or more years to recover its tone and bring forward its vast progeny; but probability is in favour of the

latter, and this probability is strengthened by the fact that, on some parts of the coast, after several kinds of fish, the haddock among others, have, generally speaking, left the fishing grounds, and the few that remain are "run," "shotten," and out of season, the fishermen have only to stand some ten, fifteen, or twenty miles from the shore, according to the nature of the bottom, and their industry is rewarded by fish as abundant and in as good condition as ever.

On some places of the coast too, where the fishermen have a little speculation, and will listen to general principles (for, generally speaking, they are a superstitious and dogged race, and can hardly be driven from an old custom, however absurd and injurious to their own interest it may happen to be), they are enabled, so to express it, to go out and meet the fish, and thus bring them to market much earlier and in better condition; nor is there any doubt that, if duly sought for, all the fish which come seasonally upon the shores of any country might be found in good condition in some parts of the surrounding seas at every season of the year. Whether this may be the case with bottom fishes, which never come close in shore to spawn, unless the depth there bears some correspondence to that over the banks on which they generally reside, it is not so easy to say, because, as they of course, in the case of their moving shoreward to spawn, take the bottom sooner or farther from the land, they are not so easily or so frequently observed. It is probable that when we come to those fishes which are absolutely ground feeders, there is very little migration for the purpose of spawning, but that they rather deposit their spawn in the banks and shallows which they habitually frequent; and as those banks, instead of being swept bare by the tide, are places of deposit for those substances which are carried in the waters of tides and currents, it is highly probable that a much smaller proportion of the spawn of such fishes is destroyed, than there is of that of those which inhabit nearer to the surface and deposit their spawn in the shallows. The quantity of the latter which must annually be destroyed by birds, by young fishes, by crustacea, and by many other creatures which inhabit the margin of the sea, must be greatly beyond what we might suppose, and thus it is not easy to say how many races of animals may be in great part supported by the excessive production of the roe fishes, and yet leave a sufficient number of those animals themselves.

There is no doubt that the circulating currents which are put in motion by the rotation and revolution of the earth, and the different actions of the sun and moon at different times of the day, and different seasons of the year, have a considerable effect upon the seasonal distribution of these fishes which come within their range, and inhabit near the surface of the waters. But we have hardly space left even to glance over the outlines of this; and even if we had, the subject is beset with very many difficulties. We do not know the depth to which those currents extend, or how the counter currents may act under them; but it is very probable that the profound depths of the great oceans are not disturbed by any of them, or even that they have much effect in changing the abodes of the still deeper inhabiting fishes, especially those of the tropical ones, where, as we have said, fishes inhabit to a greater depth than they do in the colder latitudes. But it is natural to suppose that when any of these are caught by the current and

borne into colder latitudes, that they gradually come nearer and nearer to the surface, and thus a stray fish may accidentally be found on the shores of a temperate country, which is found only in the deep in warm latitudes. We may further suppose that those strays will be found most frequently at or near the point of confluence, where two opposite points meet, or in the embayments of a shore, along which a current sweeps when approaching the point of confluence. This seems to be the reason why there are so many fishes on the south-west coast of England, which are rarely, if ever, met with on any other part of the British coast, and also why such fishes occur (though more rarely) on the shores of the more southerly of the western isles of Scotland, than on the east coast. A similar cause appears to bring the more northerly fishes to the north-west of Scotland, and through between the Orkney and Shetland islands, and so along the greater part of the east coast, in numbers far greater than they are met with on the west; and if we inform ourselves well of the directions in which those currents set, and the seasons in which they act with the greatest force, we shall be in a condition for understanding what may be called the involuntary migrations of fishes.

But notwithstanding those currents, it does not appear that a very great number even of the surface fishes follow them far out of their own seas. From the islands which lie at the south point of America, there is a counter current eastward produced there, though it is probable that out at sea, clear of the islands, the general current is westward. But notwithstanding that there is thus apparently a facility for the movement of fish both ways, it has not been ascertained that there is a very extensive exchange of fish in this way between the Atlantic and the Pacific. So also there does not appear to be any very great interchange between the Atlantic Ocean by the Cape of Good Hope; nor between the Indian Ocean and the western Pacific, either to the southward of Australia or through the passages between that great island, and the south point of the Malay peninsula, broken and interrupted as those passages are by the numerous islands which lie between. It would, however, require far more information than we at present possess, or are likely ever to obtain, to arrive at even the elements of those vast movements of the ocean, and their effects upon the ocean's inhabitants.

The peculiar manner in which the tide circulates in the Atlantic, and the portion of comparatively "slack water," as it is technically called, which is the middle of the space round which the current circulates in that ocean, has no inconsiderable effect upon the distribution of the fishes which inhabit it. In this central space there is something analogous to a floating island, only it consists entirely of aquatic plants, and plants which are never at any time rooted at the bottom, but which derive their nourishment by floating in the water, in the same manner as the duck weed (*lemna*) which mantles our stagnant pools and ditches with green in the summer. This great float of aquatic plants is known to sailors by the name of the "gulf weed;" and though it is unconnected with the bottom, it covers a vast extent, and excepting that it shifts a little northward and southward, seasonally, the great mass of it remains pretty stationary. This floating weed is a grand nursery for marine animals, not a few of which, especially the *medusæ*, are poisonous, and seem to impart that character to the

fish which feed upon them; but still this sea-weed forms a lodgment for very many of the floating mollusca and crustacea, and offers a convenient place of attachment for the spawn of the pelagic fish, the fry from which again furnishes abundant food for other fishes, and also for aquatic birds. This weed does not lie wholly quiescent; for the boundaries are everywhere put in motion by the current, so that the greater part of the mass may be said to revolve on a sort of centre. There is a similar accumulation and current, though from the position of the shores the set of it is different, in the south Atlantic; and though the Pacific is too extensive, and has been too seldom visited for enabling us to judge with accuracy of its general phenomena, yet it is highly probable that there are similar accumulations of sea-weed there which are tenanted by similar classes of animals, and visited by fish in the manner that has been described.

We cannot, however, enter farther into this most interesting, but very extensive and exceedingly difficult subject; and we have thrown together these few particulars, more with a view of drawing the attention of general readers to the wonders and the wealth of the all-productive sea, than from any hope of communicating in a few pages, anything like substantial information upon a subject, the full development of which would form materials for the volumes of a library. We shall close this desultory article with a short outline of Cuvier's

ARRANGEMENT OF FISHES. The great primary division is into two sub-classes: osseous fishes, or fishes strictly so called, which are justly regarded by Cuvier as the typical ones; and cartilaginous fishes, or CHONDROPTERYGII, under which word some account of their general characters will be found. With regard to the osseous fishes, which are by far the most numerous, they will hardly require a notice in any separate article; but the distinguishing characters of the divisions of them will be found under the names referred to in the subsequent part of this article. The two divisions now mentioned may be considered as sub-classes; and Cuvier divides each sub-class into several orders, each order into families, and each family into genera and species. Referring to the article above named for the families of the cartilaginous fishes, which form only one order, and admit of arrangement into three families, we shall now consider the list of fishes, properly so called.

These Cuvier arranges into six orders: *Acanthopterygii*, *Malacopterygii*, of which there are three orders, formed from the position of the abdominal fins, *Lophobranchii*, and *Plectognathi*. Of the first of these some notice has already been taken, and reference made to the several sub-divisions in the article ACANTHOPTERYGII, to which the reader is referred, so that we shall have to notice here only the remaining five orders, which we can do more effectively, and probably in much shorter space, than if we were to devote a separate article to each.

It will be perceived that this arrangement is not founded on the same character or part of the organisation throughout all the orders; and thus there may appear to be an imperfection about it which is not observable in the more artificial systems of others. But, notwithstanding this, each order is founded upon that structural character which is the most conspicuous; and, therefore, the arrangement is, perhaps, the best which, in the present state of our knowledge, can be made.

It would, perhaps, have given a little more neat-

ness to the system if it had been possible to find a third name, founded upon some common character of Cuvier's last two orders of bony fishes; but these are so unlike each other, and all the rest, that this would not be an easy matter. Could it be done, the true fishes would stand in three distinct divisions; two of them named from the textures of the fins, or rather of the rays of the fins, and the third of some character which is not made out in the mean time; so that at present, besides the ACANTHOPTERYGII, referred to above, there are three divisions; and the first, and by far the most numerous of the three, is divided into three orders, according to the position of the fins, as already stated.

MALACOPTERYGII ABDOMINALES have the fins with all the rays soft or jointed, and the two posterior fins on the under part placed far backwards, near the vent, so that in them the position of the four fins, which answer to the extremities of mammalia, have nearly the same relative plane on the body that the four legs have on these. This position indicates the same sort of motion as that of the mammalia, namely, motion in nearly the same plane without much ascent or descent; or that the fishes are straight-forward swimmers, inhabiting the waters at no great depth. They comprise by far the greater number of the fresh water fishes, though some of them are also inhabitants of the sea; the whole family are valuable as food: and some of them are in this respect among the most choice of the finny race. Generally speaking, their gill-openings are large, their gills perfect, and their respiration considerable; they do not, so far as we know, inhabit the waters at any very great depth; and with very few exceptions they die very soon after being taken out of their native element. There is a correspondence in the general form of the body to their habits, which renders them a very natural order. They are spindle-shaped, or with long and tapering bodies, a little compressed, but still oval in the section, with the lateral line straight, the muzzle in general small and neat, and the centre of gravity not very far from the centre of the length. In their shape, indeed, they are, perhaps, the most handsome of all the fishes; and as, from their abundance in the fresh waters, people have been more familiar with them than with most of the others, they are, perhaps, the typical fishes with most people; and when we think of a fish, it is a form such as that of one of these which first suggests itself to us. The order is divided by Cuvier into five families.

The Carp family (Cyprinoides). These are almost all fresh water fishes, some of them are found in mountain pools, where they can hardly be supposed to have come from any other waters; and there are a few which are capable of making short journeys on land. The opening of the mouth is in general but shallow, and the jaws have no great strength; these jaws are often without teeth, and the margin of the mouth is formed by the intermaxillary bones. To compensate for the want of teeth in the margin of the mouth, the bones of the pharynx are in general abundantly toothed. The number of rays in the gills is but few; the body is scaly; they have no adipose or fatty dorsal fin, as we find in the silures and the salmon; their stomach is a simple cul-de-sac; there are no cæcal appendages to their pylorus; and they are, perhaps, the least carnivorous of all fishes.

The Pike family (Esocæ). Many of these are also inhabitants of the fresh waters, but some of their characters and their dispositions are very different

from those of the former family. They have no adipose fin on the back; the margin of the upper jaw is formed by the intermaxillary bones; and the lower jaw is furnished with very large and formidable teeth. They are exceedingly voracious fishes; many of them are found in the salt waters, but others inhabit the sea; all have an air-bag; and with very few exceptions they have the dorsal fin far back, or immediately over the anal. The common pike may be regarded as the typical fish of this family.

Family of Silures (Siluridæ). These are distinguished from all the rest of the order by the absence of true scales, having only a naked skin, or that skin covered in some place with bony plate. Their intermaxillary bones are suspended from the ethmoid bone, and from the margin of the upper jaw; their maxillaries are small, or they are produced in fibrous appendages. The intestinal canal is ample, with convolutions but without cæca; the air bag is large and attached to a peculiar apparatus of bones. The dorsal and pectoral fins have often one strong articulated spine as the first ray, and many of the fishes have an adipose or fatty fin, the same as in the salmon. Generally speaking, they inhabit the fresh waters, are rather sluggish fishes, and attain a large size, but their flesh is not held in the highest estimation.

The Salmon family (Salmonidæ). This family is so interesting in very many of the genera that we shall have occasion to treat of it somewhat at length in an article SALMON, so that in the mean time we shall merely mention that in this family the body is scaly; there are in general two dorsal fins, the first with soft rays, the second very small, and adipose or fatty, to appearance without any rays; they are furnished with an air bladder, many of them inhabit the fresh waters and others ascend the rivers; they are in general very voracious fishes, and their flesh is held in great estimation.

The Herring family (Clupeæ). This is also a most interesting family, and will require a separate notice under the article HERRING, so that we need not enter into many particulars in the mean time. No species of this family has an adipose fin on the back; the upper jaw is formed as in the trout, of the intermaxillary bones in the middle, and the maxillaries at the sides, the body is scaly in all the species, and the scales are often very silvery and shining; they, in general, have an air-bag, and numerous cæcal appendages to the intestines. Most of them are inhabitants of the sea, but some are met with in the fresh waters and others ascend the estuaries of rivers.

MALACOPTERYGII SUBBRACHIATA. The general character of this order is the abdominal fins situated immediately under the pectoral, or immediately in advance, or in the rear of them. In every instance, however, all the four fins are articulated to the same bones, namely, the bones of the shoulder; and thus the power of changing its direction in motion, is concentrated upon the fore part of the fish. In those species which have nearly the form of those of the preceding order, the head is very much enlarged, and the eyes, and, generally speaking, the gape, and also the gill-openings, are much larger in proportion. The whole of the order are ground fishes, or they, generally speaking, inhabit deeper water, and find their food at or near the bottom. Most of them are sea fishes, but some are found in the fresh waters. Their flesh is, generally speaking, white, and very much prized as food. There are three families in the order.

The Cod family (Gadoideæ). This is one of the

most important family of fishes; and, therefore, we shall have to give some account of it under the specific name, when we shall bring together the principal genera, in order that we may give an account of them in the shortest space possible.

Flat-fish (*Platorideæ*). These are also very important fishes in an economical point of view, being very abundant, readily caught, and much esteemed for their wholesome and nutritious qualities. As there is no scientific name generally used for them, we shall give some notice of the principal genera and their characters, in the article *FLAT-FISH*.

Discobolus. This order has no general English name; and the scientific one is derived from the peculiar form of the ventral fins, which form a disc under the thorax. The order is not a numerous one; and the different species which compose it are more curious than useful. Some account of them will be found in the articles *LEPADOGASTER*, *CYCLOPTERUS*, and *ECHENEIS*.

MALACOPTERYGII APODA. Fishes of this order have the ventral fins entirely wanting, and, therefore, they are less fitted for ascending and descending in the water than almost any other fish. They form but one family, *Anguillidæ*, in all of which the body is elongated. Notices of the principal genera will be found in the articles *ANGUILLA*, *EEL*, *SACCOPHARYNX*, *GYMNOTUS*, *GYMNARCHUS*, and the different subordinate articles referred to from the one or the other of these.

LOPHOBRANCHII. This is a small but a singular order, the leading characters of which are, that the jaws are complete, and free or articulated, though of peculiar shape. Their principal character, and the one after which they are named, is the structure of the gills, which are not in regular fringes, like those of the generality of fishes, but formed into a sort of tuft, which are placed in pairs upon the branchial arches, and each individual fibre is divided or toothed, something in the form of a comb. These gills are attached to a large gill-lid, but there is only a small hole for the escape of the water. Their bodies are in general covered with a coat of mail consisting of scaly pieces; they are generally of small size, and their bodies contain little or no flesh. There are only two leading genera, *Syngnathus* and *Pegasus*, under which name some account of those very singular fishes will be found. From the singularity of their forms, they are called sea-needles, sea-horses, and a number of other names.

PLECTOGNATHES. These form the last order of bony fishes, and make a very near approach to the cartilaginous ones. The name of the order, as every one knows, signifies that the different bones of the jaws are soldered or united to each other. This distinguishing character is having the maxillary and intermaxillary bones united to each other, and the whole of the palatal arch attached in like manner to the bones of the cranium; but the whole of the bones are soft and flexible, intermediate between the rest of the bony fishes and the cartilaginous ones. The gill-lids are little else than thick skin; and the gill-openings are merely slits. The true ventral fins are entirely wanting. Cuvier divides them into two families which are exceedingly natural, *Gymnodontes*, and *Sclerodermes*, which are named from the peculiar way in which the jaws are armed, and of which some account will be found under those titles. Generally speaking, they are fishes of very singular form, probably the most so of any of the finny tribe. Such is a

very short outline of the systematic arrangement of fish by the illustrious Cuvier; and with which we shall close our desultory notice of this highly interesting, and truly valuable class of animals.

FISSIROSTRES (*Open-billed birds*), one of the sub-orders, or families, into which Cuvier divides the great order *Passeres*. Its general relation to the class will be seen by referring to the article *BIRD*. It is rather a small family, but the characters of the birds which compose it are peculiar. The bill is short, very broad, flat, slightly curved, and deep in the gape, and the tomia do not meet at the sides. The bill is without any notch in the mandible, which is the chief distinction between these birds and some of the flycatchers. They feed wholly upon insects, and are migratory. There are only two distinct divisions: day-feeders, which form the different swallows and swifts; and night-feeders, which comprises the birds usually termed goatsuckers. Some of the details will be found in the articles *GOATSUCKER* and *SWALLOW*.

FISSURELLA (Lamarck; *PATELLA*, Linnæus). This shell exhibits a very striking illustration of the wisdom of the present system of classification, since it differs in many important features from the patella, with which Linnæus had confounded it; taking in this, as in every other instance, the form of the shell, without any reference to its parent architect. Shells of this genus are in the form of a very depressed truncated cone, oblong or elliptical, and perforated at the summit, vertically towards the anterior part; the orifice is in connection with the animal's mantle, and never quite circular, but more frequently long, and oval-shaped, and sometimes resembling a key-hole, whence they are familiarly called *key-hole limpets*. The margin of the shell is thickened, and sometimes erenulated, and the exterior surface longitudinally ribbed, and sometimes striated transversely. There are numerous species of this mollusc: they will admit of a better defined arrangement than now exists.

FISTULANA (Lamarck.) All former naturalists considered these tubes, like those of the *Aspergillum* and *Clavagella*, which enclose and protect the animal, to be the shells themselves, but it is now satisfactorily ascertained that they are quite distinct, that genus having their shell free and detached within the sheath or external tube. This shell is bivalve, and neither of its valves fixed into the partition of the tube, which is generally testaceous, closed, and retort-shaped at the anterior end, attenuated towards the other extremity, where it is open. If the shell contained have its valves similar, but not closing together, they are what is termed gaping. The posterior open extremity is divided by a thin partition, forming internally two channels or siphons.

The animal greatly resembles that of the teredo, but is in general shorter and more club-shaped, and a great diversity of opinion exists as to the propriety of separating this genus from that, since it has been asserted that the *Fistulana* has been found embedded in wood, which it was not supposed capable of effecting, and therefore a good ground for constituting a new genus. Two fossil species are known.

FISTULARIA. See *PIPE FISH*.

FLACOURTIANCÆ is a small natural order of equatorial shrubs or small trees, with alternate exstipulate, simple leaves, shortly petiolated, often entire, and coriaceous: flowers are axillary, solitary, or congested, and they are regular and usually united, but sometimes separate by abortion. The calyx is

composed of from four to seven sepals, slightly attached at the base. Petals equal in number to the sepals, and placed alternately with them. The stamens are equal to the sepals in number; and occasionally changed into nectariferous scales; anthers free and two-celled. Germen free, roundish; sessile one-celled, ovules many. Fruit is one-celled, baccate or capsular, and filled with a soft pulp.

Flacourtia ramontchi is the Madagascar plum, so called from the resemblance of its fruit to ordinary prunes. The fruit of other species, such as *F. sapida*, *inermis*, *sepiaria*, *cataphracta*, &c., are also eatable, and the young shoots of the latter, which have an astringent bitter taste, are esteemed as a good stomachic medicine.

FLAMINGO (*Phænicopterus*). A very peculiar genus of birds, forming one of the groups which Cuvier has brought together, as detached from his regular division of *Echassiers*, or stilt birds, and which indeed differ so much from all other birds in some particulars, that they form a very small but very peculiar group, which can neither be classed with any of the rest, nor described by any common character. Cuvier himself describes the flamingo as "one of the most extraordinary and most isolated of all birds. The legs, of an excessive length, have the three front toes palmated to the end, and the hind one extremely short. The neck, not less long nor less slender than the legs, and the small head supports a bill, whose lower mandible is an oval, bent longitudinally into a semi-cylindrical canal, while the upper one, oblong and flat, is bent crosswise in its centre to join the other exactly. The membranous foss of the nostrils occupies almost the entire side of the part which is behind the transverse bend, and the nostrils themselves are a longitudinal cleft of the lower part of the foss. The edges of the two mandibles are furnished with small and very fine transverse laminæ, which, joined to the fleshy thickness of the tongue, gives to these birds some analogy with the ducks. The flamingos might even be placed among the palmipedes, but for the length of the tarsi and nakedness of the legs. They live on shell fish, insects, and fishes' eggs, which they get by means of their long neck, and by turning their head round to employ with advantage the crook of their upper bill. They build in the marshes a nest of raised earth, on which they rest astride to watch their eggs, as their long necks hinder them from adopting any other position."

The generic characters are: the bill thick, strong, higher than broad, toothed, conical towards the point, naked at the base, upper mandible abruptly inflected, and bent down on the under at the lip; the under broader than the upper; nostrils longitudinally placed in the middle of the bill, and covered by a membrane; legs very long, with three toes before, and a very short one articulated high on the tarsus behind, the fore toes connected by a web which reaches to the claws; wings middle-sized.

The principal species of this singular genus, the **RED FLAMINGO** (*Phænicopterus ruber*), of which the general colour is red, and the quills of the wings deep black, or if there be two, as is stated by some ornithologists, they appear to be but little different, except in size. The bird when full grown is not so big as a goose in the body, but it has the neck and legs longer in proportion to its general size and weight, than those of any other bird. The length from the tip of the bill to the extremity of the tail is

about four feet, or only three or four inches more; but when the legs are stretched out, the length from the bill to their extremity exceeds six feet. The



Flamingo.

neck is slender, and of an immoderate length; the tongue, which is large and fleshy, fills the cavity of the bill, has a sharp cartilaginous tip, is furnished with twelve or more hooked papillæ on each side, which bend backwards, and has a ball of fat at the root, which epicures reckon a great delicacy. The bird, when in full plumage, which it does not attain till its fourth year, has the head, neck, tail and under parts of a beautiful rose red, the wings of a vivid or scarlet red, the back and scapulars rose-red, and the legs rosaceous. The young, before moulting, have their plumage cinereous, and a considerable portion of black on the secondaries of the wings and tail; at the expiration of the first year, they are of a dirty white, with the secondaries of the wings of a blackish brown, edged with white; the wing-coverts at their origin white, faintly shaded with rose colour, but terminated with black, and the white feathers of the tail irregularly spotted with bluish brown. At two years of age the pink on the wings acquires more intensity. In all places of the world where flamingos are met with, they are highly interesting and characteristic birds, their great extent, their singular shape, their brilliant colours, and the sunny skies under which the generality of them sport over the broad waters, are all calculated deeply to interest, and widely to gratify the observer of nature. They are, generally speaking, birds of warm climates and rich places; but they are not wholly confined to the regions within the tropics. They are met with in the warmer parts of the continent, but they do not appear in any case to range more polarly than about the fortieth degree of latitude. They are common on the African coast, and the islands adjacent to the Cape of Good Hope,

and sometimes on the shores of Spain, Italy, Sicily, Sardinia, and even at Marseilles, and some way up the Rhone, but rarely in the interior of the continent of Europe, and seldom on the banks of the Rhine. We trace them on the Persian side of the Caspian Sea, and thence along the western coast as far as the Wolga. They breed abundantly in the Cape de Verd islands, particularly that of Sal, constructing on the sea shore, but so as not to be flooded by the tide, a nest of mud, in the shape of a pyramidal hillock, with a cavity at the top, in which the female generally lays two white eggs of the size of those of a goose, but more elongated. The structure is of a sufficient height to admit of the bird's sitting on it conveniently,



Flamingo.

or rather standing astride, as the legs are placed, one on each side, at full length. The female will also sometimes deposit her eggs on the low projection of a rock, if otherwise adapted to her attitude during incubation. The young are not able to fly till they are grown; but they can previously run with wonderful swiftness. In this immature state they are sometimes caught, and easily tamed, becoming familiar in five or six days, eating from the hand, and drinking freely of sea water. But they are reared with difficulty, being very apt to pine from want of their natural subsistence, which chiefly consists of small fishes, and their spawn, testacea, and aquatic insects. These they capture by plunging the bill and part of the head into the water, and, from time to time, trampling upon the bottom to disturb the mud, and raise up their prey. In feeding, they twist the neck in such a manner, that the upper part of the bill is applied to the ground. They generally shun cultivated and inhabited tracts of country, and resort to solitary shores, and salt lakes, and marshes. Except in the pairing season, they are generally met with in large flocks, and at a distance, appear like a regiment of soldiers, being often arranged in file, or alongside of one another, on the borders of rivers. When the Europeans first visited America, they found these birds on the swampy shores quite tame, gentle, and noways distrustful of mankind; and we learn from Catesby, that when the fowler had killed one, the rest of the flock, instead

of attempting to fly, only regarded the fall of their companion in a sort of fixed astonishment, so that the whole flock were sometimes killed in detail, without one of them attempting to make its escape. They are now, however, extremely shy, and one of them acts as a sentinel when the rest are feeding; and the moment that it perceives the least danger, it utters a loud scream, like the sound of a trumpet, and instantly all are on the wing, and fill the air with their clamour. Flamingos when at rest, stand on one leg, having the other drawn up to the body, and the head placed under the wing. When flying in bands, they form an angle, like geese, and in walking they often rest the flat part of the bill on the ground, as a point of support. These beautiful birds were held in high estimation by the ancient Romans, who often used them in their grand sacrifices, and sumptuous entertainments. Pliny, Martial, and other writers, celebrate the tongue as the most delicate of eatables. The flesh is not despised, even in modern times; but it is alleged by some of those who have partaken of it that it has an oily and somewhat muddy flavour. That of the young is generally preferred to that of the adult bird. The aerial march arrival, and the general movement of these birds, are described as being particularly splendid. From the high bastion which forms the promenade at the city of Cagliari, they are seen moving like lines of fire along the heavens. Those lines sometimes move on in regular order and with uniform flight; at other times the line halts, or performs a slow wheeling circular or spiral course, until they have arrived at the point where they are to rest. Nor does the beauty of the spectacle cease after the birds have alighted on the ground; for they march and wheel and perform various operations there with nearly the same order and regularity as soldiers go through their evolutions at a well conducted review. Indeed, from their great and almost equal powers on the wing and on foot, these birds are equally interesting in the air and on the earth.

FLAT-FISH (*Pleuronectes*). One of the divisions of those soft-finned fishes which are *sub-brachial*, or have the ventral fins under the pectorals, and a very curious, interesting, and valuable tribe of fishes; while their numbers in those localities which they frequent, and the very general distribution of those localities over the earth, tend greatly to increase both their interest and their value.

Of the bony fishes, leaving the cartilaginous ones out of the question, in which, however, the rays or skates bear a considerable resemblance to the true flat-fishes, these last may be regarded as the lowest inhabitants of the sea, and in this respect distinct from the others. They do not indeed dwell in the greatest depths in absolute measurement, for there are some of the other fishes having the head, and especially the eyes, remarkably large as compared with the rest of the body, that are found in deeper water than any of the flat-fishes. The flat-fishes, however, whether the waters which they inhabit be deeper or shallower, are more true to the bottom, and less prone to range than any other fishes with which we are acquainted.

We need hardly mention that the different species of flounders, soles, turbot, halibut, and several others, which get different names in different parts of the country, are the fishes to which we allude, for these are so plentiful in all our fish markets, that their general appearance and form is known to everybody.

Their manners are, however, worthy of some attention. If we could take a type for sea animals from the animals of the land, we might be inclined to say, leaving difference of food out of the question, that these flat-fishes hold nearly the same place in the waters of the ocean that the ruminant mammalia do on the land. It is true that none of them feed on the vegetable productions of the sea, for the fishes which do so have the body placed with its breadth in a different direction, and they are all fishes inhabiting near the surface, and, generally speaking, found only in the warm latitudes. But still the flat-fishes inhabit what may be considered as the fattest pastures in the sea—namely, those bottoms of mud and ooze within a moderate range of depth, and also at similar depths where the bottom is soft sand; but in general they are not found in stony places or among rocks, and it is probable that there are none of them in situations where the bottom is at any very great depth. It is of course not possible to state in general terms the distance from the shore at which the favourite abodes of those fishes either begin or end, because the difference of depth, and the character of the water off shore vary so much, even within a limited extent of coast, that each place must be determined by actual observation. In general, however, they have their chief resorts in those places where currents meet and deposit banks, or where the current of a river and the water of the sea act and react upon each other at the bottom in the course of the tides. Some of them, as will be more particularly explained when we notice the species, are much more landward than others, and found not only in the shallow parts of the sea near the shores, but in some of the species in the rivers and lakes of fresh waters. This is the case with the flounder branch of the family. The soles, which are perhaps among the least discursive of any, are generally found in currents, and in the estuaries of rivers, from about ten to twenty miles distant from the land, according to the nature of the ground; but when the shores are very steep and rocky, and have deep water at their bases, no such fish are found, and it is probable that the accumulation which is found at the bottom of such places consists of matters which are not only dead, but in such a state of decomposition as to be reduced to their merely saline and earthy ingredients, and therefore unfit for being the food of any animal.

In those haunts which are congenial to them, the flat-fishes are understood to keep very near the bottom, and to have part of their bodies buried in the soft sand or ooze, with only the head exposed. Their form is remarkably well adapted to this habit, and it is a form which differs greatly from that of any other vertebrated animal.

In respect of the general action of their bodies, the flat-fish still preserve the typical form of a fish, that is, the action of the spine is lateral with regard to the true mesial plane of the great mass of the body, and different from all the land vertebrated animals which have the principal action of their spine vertical as respects this plane. In the flat-fish, however, the plane of the body is turned, so that instead of swimming with the back uppermost and the belly undermost, as is the case with other fishes, they swim upon the side, and with both edges of the mesial plane equally produced through the greater part of their length, and only with the cavity of the body, which is generally very short in the extended part, turned a little to

one side, and the top of the head turned a little to the other. From this form the whole fish is enabled to swim as one continuous flattened body, while the eyes, which are generally very small and close together, are on the upper surface, the mouth being placed more or less obliquely to one side or other of the snout, and the fins, which answer to the extremities of quadrupeds and birds, placed on the upper and under sides, though also a little obliquely. Generally speaking, the kind of colour and also texture of skin which characterises the whole back of any other fish, is confined to the side of the flat-fish in which the eyes are situated, and the other side, which is never turned up in swimming, is always white. There are some species, however, in which both sides are covered nearly in the same manner, but there is none in which both eyes are not on the same side of the head, as estimated from the position in which the fish swims.

If the skin is removed, it is found that, though the upper and under sides are not quite the same in their muscular texture, or in their quantity of muscular substance, yet that they have a very near resemblance to each other in the arrangement of their fibres. The principal action of the body consists in bending the spine downwards, that is in giving it a concavity at the middle of the under side, and in some of the species this motion appears to be so differently communicated to different parts, that there are several contrary flexures of the spine at the same time. It does not appear that the spine of these fishes is capable of much motion laterally, or that the last is with them the chief organ of progressive motion, as it is in other fishes. The tail can only strike the water upward or downward, and therefore is effective more as a means of ascent and descent than of forward motion.

It is with the side or lateral fins, answering to the dorsal and anal fins of an ordinary fish, that the progressive motions of flat-fishes are effected. These fins, no doubt, strike the water upward or downward, and not laterally; but then the bendings which are produced in the body, and in the extremities of those fins, produce a progressive motion, though it is slower, and performed with much more labour in proportion to the effect than in other fishes; because, while the bodies of these fishes are curved vertically in swimming, the different parts of them are subjected to different pressures of the water, and a portion of the action is taken off by the resistance of the other part of the bend. The pectoral fins are rather small in most of the species, but the dorsal and anal are continued throughout nearly the whole lines of the sides, or rather of the ridge of the back and under part of the body, for these are the true situations of the swimming fins of the flat-fish. When the fish is laid down with its eyes upward, its natural position in the water, that fin which is on the same side with the eyes is to be considered as the dorsal fin; and the one on the opposite side, where the mouth, the gill-openings, and the vent are met with, is to be considered as the anal fin. In most of the species the pectorals are situated just in the rear of the upper angle of the gill-openings, and the ventral fins in advance of these, near the commencement of the anal fin, and partially twisted a little from the side in which the eyes are. These four fins are, however, as we have said, very small in size, and they cannot be very efficient in any motion

of the fishes. It is in consequence of having those marginal fins along what appear from its position in the water the two sides of a fish of this kind, that the name of *Pleuronectes*, or "swimmers by means of the sides," was first given to those fishes by Artedi. This name is certainly founded upon the most remarkable structural character of these fishes, and therefore it serves well enough for distinguishing them from other fishes; but if we are to consider the side of a flat-fish as having the same position with regard to the spinal column which the side of any other fish has, then it is not by means of fins attached to the sides, but by fins attached to the ridge of the back and the middle of the belly, that those fishes perform their principal motions in swimming.

Flat-fishes have the head small, and also short, in proportion to the whole volume of their bodies; the opening of their mouth is also small, and the teeth very minute. Their gills are rather contracted, and in many species the gill-lids consist of only a single piece. There are six rays in the gills, but their whole volume is small as compared with that of the fish, so that their quantity of breathing must be limited. The cavity of the body is very small and short, but it is prolonged in small sinuses toward the tail. They have no air bladder; and, indeed, if we are to adopt the common opinion, and suppose that this viscus has anything to do with the change of specific gravity, and consequent ascent and descent of the fish, we might conclude that such an apparatus would be quite superfluous in those flat-fish, inasmuch as their most powerful action in swimming is an ascending or a descending one. They, however, do not avail themselves much of this, as they seldom rise far from the bottom, and their motions, when they do rise, are very slow and wriggling. They cannot, indeed, make much way without so much flexure of the body, as exposes a considerable portion of their white sides, and thus renders them very conspicuous objects to those fishes which prey upon them, and they are the chief food of several species of the voracious cartilaginous fishes.

In general they remain placidly on, or near the bottom, sometimes with only a little portion of the upper surface of the head exposed, and then their colours on the upper part are generally so similar in colour to sand and mud, that their enemies have some difficulty in finding them out. Many of them are very prolific: the spawn of the common flounder, for instance, containing little short of a million and a half of germs; nor is it unworthy of remark that there appears to be in this class of fishes a considerable correspondence between the powers of production, and the absolute numbers and distribution. The sole, for instance, which, though abundant in its localities, is a much more local fish than the flounder, does not produce above a tenth of the progeny; and this gives us some reason for thinking that, though we are not in possession of all the elements necessary for the full establishment of the fact, there is a good deal of correspondence between the productive power of fishes, and their actual numbers.

Nor can we fail to admire the great degree of concealment which those fishes derive from their shape and colour. When they are on the bottom, it is not very easy for any other species of fish to see them or to seize hold of them even if they should; and they themselves are, on the other hand, placed in the very situation in which they can use their eyes with the greatest possible advantage, both in finding their own

food, and in escaping from becoming the food of their more powerful neighbours. Their forms, their situation at the very bottom of the water, and all their habits, cut them off from almost every means of safety excepting concealment; for they have less scope for escaping, and are less fitted for availing themselves of the scope they have, than any other race of fishes.

From the character of the mouth, the smallness of the teeth, and the fact of some of the species having teeth only on one side of the mouth, it is evident that flat-fishes are not capable of taking prey of any great size. So also, from what has been said of the feebleness of their powers of motion, it must be evident that they are not adapted for giving chase to any animal which can get away from them, with even a moderate degree of speed. Still, the whole race are animal feeders, and in proportion to the extent of their powers, they are voracious. Indeed, fishes of all kinds are great feeders; and, though some feed upon minute substances, and others swallow fishes, much more nearly equal to their size than one would at first sight be led to expect, yet they all feed more greedily, and perhaps more largely than the majority of land animals. It is probable that the muscular powers of fishes are much less subject to fatigue than those of land animals; and though they spend a good deal of their time in a state of rest, either in the volume of the waters, or at the bottom, it is doubtful whether any of the species have a renovation by sleeping, at all resembling that of land animals. From the slowness of their motions, and the little range in distance which they require to undergo, it is highly probable that the flat-fishes have less muscular exertion than most others of the class; but as it is impossible to observe their habits with any minuteness, nothing very positive can be declared respecting them. In all probability their chief food consists of those molluscous animals, and minute fishes, which the tides and currents of the bottom carry along, and deposit on the banks, and other places where flat-fishes abound. That they do not feed upon any sort of ground animal, but on something which floats in the water over them, is proved by the position of their eyes, which are probably the chief organs in guiding them to their food. They very readily, however, take bait in small pieces, and though most of them prefer molluscous animals, a little bit of almost any fish will suffice. Those which ascend the estuaries of trouting streams are often very annoyingly deceiving to those who use bait in angling. The flat-fish catches very readily at the bait, and as the form and twisting up and down of its body, render it much more difficult to pull through the water than any common-shaped fish, the hope of possessing a trout four or five pounds in weight, changes into the actual possession of a flounder of not the same number of ounces.

There are a few difficulties connected with the natural history of flat-fish, as indeed there are with every fish, and more especially with every fish which keeps much below the surface. It seems too, that there are sometimes peculiarities in individual specimens of species which are well known, such as the head twisted the other way, or the sides of nearly the same colour. But still the general characters of the family are obvious and well marked, so that there is never any risk of confounding any one of them with a fish of any other kind. Considered as articles of food, there is great difference, and this applies not only to the quality, but to the quantity, of eatable matter

which there is, in proportion to the apparent size. We believe that the whole tribe are wholesome, though in some the flesh is too soft, and in others it is too hard for their being of much value; but upon the whole they may be considered as valuable fishes to man; so is the case with almost all bottom fishes. They are rather tenacious of life, though probably not so much so as eels; but they do not keep so long after they are dead as eels do, nor do they answer for salting. Taking all these circumstances into consideration, they may be regarded as forming a coast supply, rather than one which admits of being carried far into the interior. On the coast, however, if the bottom is favourable for them, they are found in great abundance, and some of them continue longer in season than most other species of fish; and this is the case most generally with those which are of the best quality, a circumstance which farther increases their value in an economical point of view.

This family of fishes has been differently arranged by different describers and classifiers of the finny tribes; but in giving a short enumeration of the leading species, we shall follow the arrangement of Cuvier, which has the advantage of both accuracy and authority. According to this arrangement the great genus *pleuronectes* is divided into seven sub-genera; but the character, of which we have given a short outline, is pretty common to all those divisions. We have already mentioned the sixth and seventh of those sub-genera, in the article *ACHIRUS*, so that we have now only the remaining five to enumerate. These are *Platessa*, plaice, and flounders of different kinds; *Hippoglossus*, halibuts; *Rhombus*, turbot; *Solea*, soles; and *Monochirus*, which is nearly related to the ordinary soles in its general characters, only it has the pectoral fin on one side almost or altogether obliterated. The other two divisions, *Achirus* and *Pegasus*, are also soles, in which both pectoral fins are obliterated.

PLATESSA. The general characters of this sub-genus are: a row of blunted cutting teeth in each jaw, and very often flattened teeth on the pharynx; the dorsal fin reaches up only to below the upper eye. It, as well as the anal fin, is smooth, and there is an interval without any fin between each of these and the caudal. Their form is that of a lozenge or rhomboid, and most of them have the eyes on the right side of the head. They are common in most seas, and some of the species enter pretty largely into the estuaries of rivers. The most plentiful species is: the fluke, common plaice, or Dutch plaice, which is very abundant in the seas and waters which are not very deep, and have muddy bottoms. It is characterised by a row of six or seven tubercles, forming a line on the right side of the head, between the eyes; its colour above is olive, spotted with small dots of aurora red, and the under side is white. It grows to the length of about a foot, is understood to spawn about the month of February, and thus it is in season during great part of the year. It is obtained in greater numbers, and in more places of the sea than most of the others; but, though its flesh is wholesome when recent and in good condition, it very soon becomes tainted, so that there are more unwholesome plaice brought to market than almost any other fish. The mouth of this species is small, and has the lower jaw longer than the upper; the scales upon it are small, pressed deeply into the skin, and firmly attached. The general number of rays in the fins are seventy-two in the

dorsal, eleven in the pectoral, five in the ventral, and fifty-four in the anal.

The *Flounder* (*Platessa flesus*) is about the same size as the former, but differs in the marking of the body, and texture and appearance of the skin. In general the ground colour on the upper side is olive, marked with brown, and occasionally with intermediate patches of whitish, yellowish, or reddish, but it never has the same bright aurora spots as appear on the back of the fluke. There are small sharp spines along the lateral line, and at the junction of the dorsal and anal fins with the body; and the lateral line near the fore part is bent upwards. This is the least seaward of the whole family; and is often found at such a distance up the rivers as that the water has not the least taste of salt. It occurs most frequently, however, in rivers the feeders of which flow through rich soil, and thus deposit great quantities of mud and silt in the eddies of slow currents; and it is chiefly in such places that this fish is to be met with. The quality of its flesh depends a good deal on the water in which it is found; but though it is esteemed in those rivers which contain comparatively few fish of superior quality, it is not very superior to the fluke. From the number of situations in which the flounder is met with, it may be naturally supposed that there are many differences in respect to size and appearance; and it is also worthy of remark that though the generality have the eyes on the right side of the head, specimens are often found which have them on the left, and which evidently belong to this species. It is understood that this species, like the former, spawns in the winter; and therefore, like that, it is a summer fish for the table.

The *Dab* (*Platessa lemande*). The common dab is nearly of the same size and shape as the fluke, but its mouth is wider, its eyes are larger, and so are its scales, which are rough or partially toothed in the margins. Its teeth are also more large and more pointed, standing in an even row in each jaw. The colour above is brownish, frequently mottled with darker blotches, and occasionally with whitish ones. It is a very common fish, spawning in May, and for this reason is in best season for the table, when the early spawners are "run" and unwholesome. Its flesh is perhaps not so delicate as that of either of the former two, when they can be obtained quite fresh and alive; but as it does not decay so soon, it is better for supplying markets far from the coast.

There are many other species of this genus which are less frequent upon the British shores, but their history is rather obscure; and it is not unlikely that an accidentally formed or coloured variety, especially when young, has been occasionally figured and described as a distinct species. A larger species is mentioned by Cuvier under the name of *Platessa latus*, which is much broader than the common ones, the breadth being equal to two thirds of the length, but very little is known respecting it.

All the species of *Platessa* are gregarious, collecting in considerable numbers on favourite spots, and seldom quitting these to range in the turbulent waters. Their peculiar form enables them to swim in water of no great depth, so that, in one or other of the species, they are very generally distributed over the coasts.

HIPPOGLOSSUS—the halibut—grows to a much larger size than any of the first sub-genus. It is often more than two feet in length in the British markets, and

specimens of more than double that length are not uncommon, while in the North Sea, where it is particularly abundant, it has certainly been met with eight feet long, or, as has been stated, as much as eighteen or twenty. It is a far more hardy fish, and therefore more discursive than the former ones. In some of the northern countries of Europe it is obtained in great abundance, and salted as provision against those times when, on account of the violence of the weather, the abundance of the sea cannot be got at directly. Halibut, though a thick fish, and containing a great quantity of muscle, is strong and hard, entirely destitute of the delicacy of the better species of *Platessa*, or of the richness of the turbot. Hence it is in little estimation among those who are curious in fish, and consequently sells at a moderately low price. As its range is more discursive than that of the turbot, it is much more easily caught, and there are many parts of the British shores where halibut is known as turbot, and the real turbot is termed a flounder or fluke, and sold as such. This we believe is, or at least was lately, the case in Edinburgh, in the estuary below which there is understood to be good fishing both for turbot and sole, but, either the fishing-ground is too far off, and improperly understood, or its value has been overrated, for the fishing has not hitherto succeeded. Strange stories are given of casualties that happen to large and overgrown old halibut, especially in the North Seas. It is said that their backs, which are of ample extent, become grown over with crops of sea-weed, in consequence of which they are unable to keep below the water, and thus to float sickly on the surface, until they are devoured by gulls and other aquatic birds. It is no doubt true that, owing to causes which we are not very able to explain, these fishes, as well as many other of the inhabitants of the deep, are often found floating dead on the waters, and soon become a prey to those birds whose business it is to consume the refuse of the sea; but the fact of a grove of marine vegetation upon the back of a living fish is rather too much for ordinary credulity, and puts one more in mind of a story told and credited on the banks of one of our northern rivers, where a salmon, having been speared with an instrument, the shaft of which was formed of a green sapling of mountain ash, swam down with it to the sea, and returned on its migration next autumn bearing a beautiful cluster of berries of the mountain ash on the top of the spear. The fact is, that, in endeavouring to obtain anything like good accounts of the local characters of fishes, or any other animals, in the North Seas, the people there are so remarkable for the extent of their credulity, and the singular stories which they manufacture for its gratification, that, if one trusts much to them, there is every certainty of being deceived, without any intention on their part to deceive us. It is probable that there are several varieties of halibut. The general character of all is the lateral line arched behind the pectorals; but there are some in the Mediterranean which have different characters. A small species there has the eyes on the left side of the head, and some others have been described intermediate in their form between the common halibut and the turbot; and some idea of the mass of individuals of this sub-genus caught in the North Seas, may be formed from the fact of their being sometimes caught upwards of two hundred pounds in weight.

RHOMBUS. The turbot sub-genus contains several species, which all have the mouth entire, the teeth numerous and slender, placed both in the jaws and on the pharynx, which characters they have in common with the halibut, but they want the spine in front of the anal fin, and the lunulated form of the tail which characterise that sub-genus. They have also the eyes on the left side of the head, and this character renders it probable that the left-headed halibut of the Mediterranean may in reality be a turbot, while some of the right headed turbots which have been described are probably halibuts.

Of all the species, the common turbot, *Rhombus maximus* (*Platessa maximus* of Linnæus), is the most celebrated. It is usually more than two feet in length, and sometimes weighs more than twenty pounds. Its general outline is between a lozenge and a circle, and having the length and breadth nearly equal. When in good condition the turbot is reckoned one of the finest of sea fishes. It is covered with small scales, and the upper and under surfaces have small tubercles upon them, which are, however, most conspicuous upon the upper side. The colour of the upper side is yellowish, eluded with brown; and that of the under side white.

The estimation in which this fish is held as an article of food makes it an object of great interest to the fishermen on many parts of the coast. It is by no means uncommon on most of the British shores, though, as it resides more in deep water than the flounders, and is more peculiar in its localities than halibut, it is not so frequently taken as it perhaps might be. It seems to be rather more abundant in our warmer seas than in our colder ones. But correct information on this point, and indeed on very many points connected with the distribution and nature of our fishing grounds, is still very much wanted. Turbot is fished for with hooks and lines, and the bait made use of is either mollusca, such as muscles or limpets, both of which make very excellent bait, or bits of herring, haddock, or of most other fishes; but the bait for turbot must be quite fresh and recent.

Brill (*Pleuronectes rhombus* of Linnæus) is smaller than the true turbot; has the body oval and without tubercles; and is farther distinguished from the others by having the first rays of the dorsal fin a little free, or in the form of threads at their extremities. The smooth soft skin, however, as contrasted with the rough and tuberculated one of the turbot, is however the most obvious distinguishing character. The colour above is yellowish spotted with brown, yellow, and white, while there is rarely any white on the upper part of the turbot. The flesh of the brill is inferior to that of the turbot, both in flavour and in its other qualities; but still it is very superior to that of the halibut; and though brill does not fetch any thing like the price of turbot at the markets, it is still a fish which is in considerable repute. The method of capture is nearly the same with both species; but the fishing grounds differ, as brill often makes its way a considerable distance up the estuaries of the larger rivers, which is not the case with turbot.

There are two or three other species or varieties of this sub-genus, of which specimens are occasionally, though rather rarely, taken on the British coasts, especially on the south-west coasts of England and Ireland. But in attending to these rare and transient fishes, if we are to treat of fishes in a popular and economical point of view, we must be careful not to

confound the estimation in which they are held by professed and systematic naturalists with that in which they deserve to be held by the public generally. With the naturalist every animal is esteemed very much in the proportion of its rarity, so that one strange fish previously unknown is received with greater pleasure, and esteemed of more value than a whole boat load of the very best fish that was ever brought to market. This is all very well in so far as promoting the mere science of the matter is concerned; but as the end of all real science is usefulness, it were desirable that at least equal attention should be paid to that which is of the greatest value. Acting upon this conviction, we shall briefly notice those rarer species or varieties, even such of them as appear on the British coast, while we shall pass in silence those others which are equally rare in the general ichthyology of the world.

The Whiff (*R. megastoma*). This species receives its trivial name from the size of its mouth, which is large, and has the lower jaw the longest. The lateral line forms a large arch near the pectorals, and is marked by a row of tubercles along its length. The dorsal and anal fins are broadest toward the middle. The length is about a foot and a half, the colour of the upper part mottled with brown of different shades, and the under side white with a blush or tinge reddish. The eyes are large and stand up from the head, with irides of a golden yellow colour. The extremity of the tail is slightly rounded. This species has been long known upon the south coast of England, but has never occurred in such numbers as to render it a very interesting fish, in the popular sense of the term. It is more elongated in its form than most of the sub-genus.

The Top-knot (*R. punctatus*). This species is still rarer; and if those specimens which have been casually met with have been full grown ones, it is much smaller than any of the others, rarely exceeding five or six inches. Its body is rounder than that of the whiff, and the surface is rough from the scales having little projecting teeth or spines to the number of from four to eight on each scale. The colour on the upper part is black with spots of brown, and small dots of red; and that on the under side is white. It has been principally described from specimens taken from the Cornish coast; but from some of the accounts it appears to be much more common on the Shetland islands, at the opposite extremity of the British dominions. It is too rare, however, and too insignificant to be an object of general interest.

The Scald-fish (*R. arnglossus*) is a small species very local on the southern coast, so far as observation has gone. In shape it resembles the sole more than the turbot. We quote the following description of it from Mr. Hammer. "The colour of the upper side is a pale brown or dirty white. The body has something of the same pellucid appearance as the lantern, though in a less degree. Head rather small; the jaws of equal length, blunt; the lateral line bent near the head. The dorsal fin consists of eighty-two rays, as does the anal, which reaches to the tail, the pectorals of ten rays; a double row of rays, five in each, from the ventral fins; behind is one or more short and sharp spines; the tail is rounded at the extremity; the rays of all the fins, including those of the tail, are bristly, and connected by a thin fibre or pellicle, which is easily broken. The scales are so deciduous that the friction of the trawl alone is sufficient to remove

them; when taken out of the net they are usually dead, and in that bare state, which gives some propriety to the name they are known by, of scald-fish. They seem only to be known at Plymouth, and occur there very rarely. Their length is rather more than five inches; their breadth not exceeding two inches; and are probably the smallest of the English species, and of corresponding value."

From the accounts which are given of these smaller members of the turbot sub-genus, it is probable that they run more into the character of the soles, than into that of any of the other sub-genera; and it is worthy of remark, that the sole and the turbot, which are the typical fishes of their respective divisions, are also the best in quality of all the flat-fishes; and that the sole especially is the one which is the most constantly in season.

SOLEA. The fishes of this division are perhaps, when we take all their qualities into account, the most valuable of the whole of the flat fish. Individually, they are not nearly so large as turbot; but when in fine condition they are perhaps more delicate; and their great abundance and long continuance in season are considerations of great importance. There are some different species or varieties of soles; but the distinctions between these are not very great; and there appears to be much similarity in the manners of the whole. They are fishes of the temperate rather than of the cold latitudes; and for this reason they are far more abundant on the southern parts of the British coasts than on the northern.

The most remarkable character of the soles is that of the mouth, which is different from the mouth of any other fish. It is twisted, or forms a curious oblique crown; and that side on which the eyes are situated has no teeth. The teeth on the other are also very small, and arranged something like the pile of velvet. Their general form is oblong; their muzzle rounded, and almost always projects beyond the mouth, the dorsal fin begins at the mouth, and both it and the anal fin are united to the caudal; thus forming a margin of fin round the whole body, with the exception of a small portion at the head end. The lateral line is straight; and the side of the head opposite to the eyes is generally villous. Their intestines are long, without cæca, but often with considerable duplications.

The species best known is the common sole; *Solea vulgaris*, which varies in length from about one foot to nearly two, and weighs from one pound to seven, though specimens of the latter weight are not very common. Its colour on the upper part is brown, and that on the under part white. The irides of the eyes are yellow, with a trace of red. On the head the lateral line is curved upwards, but it is straight in the rest of the body; the caudal fin is pointed or rounded. The scales, which are small, are rough, and fringed at their margins with about ten small spines. These scales are very beautiful in their structure, and much prized as objects for microscopic display. The skin is also strong and tough, and contains a great quantity of gelatine. The flesh when of good quality is peculiarly white and firm, and understood to be very light and easy of digestion. Soles are generally taken by a trawl net at considerable depth in the water, and at the distance of from twelve to twenty miles from the coasts. They are sought after with considerable avidity.

In the warmer seas, and in the Mediterranean

among others, there are several which are but little known on our coasts, but stray ones are occasionally met with. Of these strays, one of the most remarkable is *Solea pegasa*, which was first discovered as a British fish by Mr. Yarrell; though the fishermen in the channel have been acquainted with it for some time. The specimen described by Mr. Yarrell was eight inches in the entire length, and three inches in the greatest depth of the body, without measuring the fins. This is a much greater breadth in proportion to the length than the common sole; and the body of the fish is also more plump and fleshy, and its head blunter, shorter, and wider. The mouth is very much arched, the operculum formed externally of a single piece with a circular margin. The ground colour on the upper side a mixture of brown and yellow, with small spots of dark brown; and the tip of the pectoral fin black. There are fewer vertebræ in the spine than in the common sole, three rays fewer in the dorsal fin, one more in the pectoral, and two more in the anal, but the other fins are the same, only the tail fin is narrower in proportion. When found, this species has generally been about sixteen miles off the land, and on a bottom of clean sand. It does not appear that its flesh is inferior in quality to that of the common sole; and indeed there appears to be no great difference of any of the members of the subgenus, in whatever part of the world or locality of the sea they may be found. It seems that the sole does not get either into the strong current, or very close to the land, but rather remains on the banks when there are eddies, and deposits of matter on which it can feed; and it does not appear to rise to any great height from the bottom. Indeed from the difference in form between it and most of the others, it is probable that it is more completely a ground fish than any of them. Soles are always gregarious, or live in shoals on the same grounds; but as they are seldom, if ever, seen except when they are taken forcibly from their dwelling places by the net, we know very little of their economy or manners.

MONOCHIRUS. The fishes which form this subgenus, and which do not appear to have occurred on any part of the British shores even as wanderers, are soles in their general characters; and the distinction between them is chiefly in the pectoral fins, that on the same side with the eyes is very small, and the other one is either wholly wanting, or so mere a rudiment as to be barely perceptible. But as it is not easy to ascertain the precise mode and extent in which the pectoral fins of flat-fishes assist in their very singular kind of swimming, it will serve little purpose to speculate about the influence which the peculiar form of those fins in the ones now under consideration may have. The whole tribe or group are amongst the lowest dwellers in seas where observation cannot well reach them; and therefore we can say little respecting them which is not in a great measure conjectural. It is probable, however, that the quality of their flesh is superior in proportion as they have less muscular labour to perform in the search of their food; but they are truly a curious as well as a useful and valuable race.

FLAVERIA (Jussieu). A genus of South American herbs, one species of which is used in Chili for dying yellow. Class and order *Syngenesia segregata*, and natural order *Compositæ*.

FLAX, an extensive genus of annual and perennial herbs, found in many different parts of the world.

The most useful is the *Linum usitatissimum* of Linnæus; an annual found within Britain, and much cultivated both in Scotland and Ireland, as well as in many countries in the north of Europe. A most useful oil is expressed from the seeds, and the residue called linseed cake is used as one of the most fattening kinds of food for cattle. But the flaceous substance obtained from the stalk is the staple material of the linen manufacture. Lint is the common name and is an agricultural plant. It is sowed on clean and well prepared ground in the spring, flowers in the summer, and ripens its seed in the autumn. When stripped of its capsules, the stalks are tied up in bundles and steeped in water till the woody part becomes fragile, so that it may be broken or bruised in a mill, to prepare it for the various processes of the flax dresser.

FLAX LILY is the *Phormium tenax* of Forster, an economical sedge-like plant, found in New Zealand. It is an hexandrious herb, and belongs to the natural order *Asphodeleæ*. It takes its name from being employed by the inhabitants, where it grows naturally, in the manufacture of baskets, and it has been introduced into Europe as a fit plant to take the place of hemp; as the fibres obtained from its long leaves after maceration are said to be much more tenacious than any other vegetable fibre known. Whether it will be found hardy enough, for the climate of Britain is not yet ascertained, but if it could be naturalised and cultivated so far as to furnish material for the manufacture of ships' cables, it would be a valuable acquisition. The imported phormium flax has been manufactured and tested with the best hemp, and found of superior strength.

FLAX STAR is the *Lysimachia linum stellatum* of Linnæus, a herbaceous annual, indigenous of Italy. It is pentandrious, and belongs to the natural order *Primulaceæ*.

FLEA, the ordinary generic name of a genus of small annoying insects, of which the various species attack man, and various animals and birds. See the article **PULEX**, under which name the natural history and structural peculiarities of the insects will be given.

FLEABANE is the *Coryza squamosa* of Linnæus, a herbaceous biennial, native of Britain, but of no known use—not even that attributed by its name. It belongs to the natural order *Compositæ*.

FLEMMINGIA (Roxburgh). A genus of herbaceous and half shrubby and creeping perennials, chiefly natives of India. Class and order *Diadelphia Decandria*, and natural order *Leguminosæ*. Generic character: calyx bracteate, five-parted; standard striated; pod sitting, oval, turgid, two-valved, two-seeded; seeds globular. Several species are in our stoves, and are propagated by cuttings in the usual manner. Their flowers are not very striking.

FLINDERSIA (R. Brown). A lofty timber tree, a native of New Holland, introduced about 1825. The flowers are decandrious, and the plants belong to *Meliaceæ*. Generic character: calyx five-cleft and persisting; petals obtuse and flat; disk surrounds the germen, cup-shaped, having ten plaits and somewhat crenated; stamens rise from the disk, alternately fertile and abortive; style simple, five-sided; stigma peltate, and five-lobed; capsule woody, spinous, five-celled, seeds winged at the apex.

There is only one species described; succeeding well with ordinary hothouse management.

FLOSCUCULI or cuckoo flower, is the *Lychnis flos cuculi* of Linnæus, a common British plant abundant in moist meadows, so called from its flowering about the same time with the arrival of the cuckoo. There is a double variety of it met with in gardens. It belongs to the natural order *Caryophyllæ*.

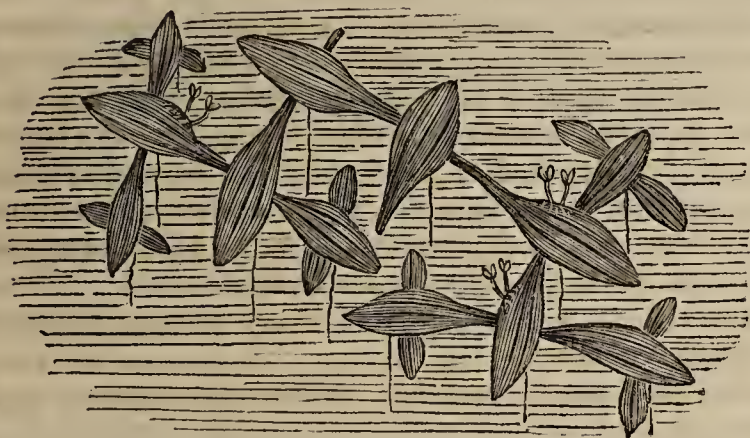
FLOS JOVIS is the *Lychnis flos Jovis* of Linnæus, a common British weed found on hedge banks and sides of roads.

FLOWER FENCE is the *Poinciana pulcherrima* of Linnæus, one of the most beautiful of Indian plants. It belongs to the *Leguminosæ*; and when kept in a strong heat flowers readily in our stoves. It is propagated by cuttings, but much oftener by seeds brought from its native country.

FLOWERING ASH is the *Ornus Europæa* of Persoon, a hardy deciduous tree, common in our arboreta, and belonging to the order *Oleina*.

FLOWERING RUSH is the *Butomus umbellatus* of Linnæus, a beautiful British plant found in pools and wet ditches.

FLUVIALES, an order of aquatic plants, otherwise called *Nayadaceæ* or *Hydragetons*, and by some botanists *Potameæ* and *Potamopheleæ*. Like the



Fluviales.

Lemnaceæ, these plants are believed to be destitute of spiral vessels, or if not wholly absent, they are nearly obsolete; in *Caulinia*, Amici says, no trace of them can be found. Their cellular structure likewise remains uncondensed in its outer layers; therefore no cuticular integument is formed, and they are devoid of stomata. Hence both these types descend in structure nearly to the rudimental state of the *Algæ*, from which, however, they are distinguished by their flowers, when the other diagnostics fail.

The most useful of this order is the *Zostera marina*, or grass-wrack, which forms an excellent packing for brittle ware; it is also platted into coverings for bottles and oil-flasks: and lately under the name of *Alga marina* it has been recommended for stuffing mattresses, being tolerably light and soft, and intolerant of vermin: a great recommendation in many places.

FLY. A name indefinitely given to all insects having gauze-like naked wings—as well as even to several kinds of beetles. Thus the *Haltica nemorum* is called the turnip-fly, and the *Elater noctilucus* fire-fly. If we would take the name in its most restricted sense, the common domestic-fly, *Musca domestica*, appears most entitled to it. See **MUSCIDÆ**.

FLY-CATCHER (*Muscicapa*), a genus of birds placed by Cuvier in the first or *Dentirostral* sub-order of the great order *Passeres*, and forming the second

family of that sub-order, or the one immediately following the shrikes in structural arrangement. The birds, however, which the elder naturalists were in the habit of arranging indiscriminately as fly-catchers, are so exceedingly numerous, and differ from each other in so many points, that Cuvier has divided them into several sub-genera, of which the names are *Tyrannus*, *Muscipeta*, *Muscicapa*, *Gymnocephalus*, and *Cephalopterus*. When we come to give a more extended notice of the details, we shall be enabled to point out how those sub-genera differ from each other, while they all agree to some extent, at least in the general habit of feeding upon flies; but even here the species of some of the sub-genera are so exceedingly numerous, and the materials we are in possession of are so scanty, that it is impossible for us to enter into descriptions of them, nor if we could would it be of much utility, as the greater number are known only as museum specimens, though in their native localities most species are understood to be as abundant as the species themselves are numerous. The following is a description usually given of them by those who profess to connect the characters of birds with their external expression, and in this instance it is almost all we can obtain. They are birds which dwell in wild and solitary places, and are characteristic of wild nature, and not of the earth as cultivated by man. Their expression is accordingly sullen, and many of them have a fierce and pugnacious air. As they are obliged to seize upon their prey in mid-air, they are almost always perched upon the summit of trees, and rarely descend to the ground. As they are chasers of flies, their true country must be in the wooded regions of the globe. Accordingly, for three or four species which are known in Europe, we reckon in Africa a great number, also in the warm climates of Asia, and Australasia, and still more in America. In this last continent we find the larger species which have been denominated tyrants. As nature has increased the growth, and multiplied the number of insects in the New World, so has she opposed to them enemies more numerous and more powerful. It is a trite observation, but one which the study of nature illustrates at every step, that all in this world is balanced. When evil exists, there will always be found some equiponderating good, and it rarely happens that any one species, or genus, is suffered to multiply and extend to the serious prejudice of another. We see, it is true, everywhere a great destruction of life, but we also see an equivalent reparation; we must not take a circumscribed or conventional view of the grand operations of nature. It is impossible for any one who has not actually visited them, to form any adequate idea of the activity of life, both animal and vegetable, in those portions of the tropical countries where the powers of nature are almost unceasingly at work, or of the energy of the same powers, and the greatness of their results during the short summers of even the polar countries; and, as the productions of nature all subsist upon each other, the destroyers are always adapted to the destroyed, so that the balance of nature is kept up.

The following passage from Buffon, though perhaps not perfectly true to nature and philosophy in every respect, yet affords so lively a picture of the service which birds render in the destruction of insects, that we shall not hesitate to give it a place in our pages: "Without them," (that is the birds,) says this flowery writer, "without their assistance, vain would be the efforts of man to destroy or banish the clouds of fly-

ing insects by which he would be assailed. Innumerable in quantity, and rapid in generation, they would invade our dominions, fill the air, and devastate the earth, did not the birds restore the equilibrium of living nature, by the destruction of her superfluous products. The greatest inconvenience of warm climates is the continual torment caused there by the insect tribes. Man and the quadrupeds cannot defend themselves against them. They attack with their stings; they oppose the progress of cultivation, and devour the useful productions of the earth. They infest with their excrements or their eggs all the provisions which are necessary to be preserved. Thus we find that the beneficent birds are not even sufficiently numerous in such climates, where, nevertheless, their species are by far the most multiplied. How happens it, that in our temperate climates we are more tormented with the flies in the commencement of autumn, than in the middle of summer? Why in the fine days of October do we see the air filled with myriads of gnats? Because all the insectivorous birds such as swallows, nightingales, warblers, &c., have deserted us. This short lapse of time, during which they have too prematurely abandoned our climate, is sufficient to cause us to be more incommoded with the multitude of insects, than at any other season. What then must be the consequence, if, from the moment of their arrival—if, during the entire summer—if, in short, for the whole time of their sojournment among us, we continue to make their destruction a source of amusement?"

Birds of this genus, or rather family, are found in all the warmer parts of the world; and some migrate towards the poles in the summer, and it is even said that they winter in some of the polar countries; but though this should be the case in some solitary instances, it is contrary to the usual habits of the birds, and forms no part of their general character. The more powerful ones very much resemble the shrikes both in their appearance and manners; and, though none of them are, expressly speaking, birds of prey, living principally on feathered game, yet not a few of them do occasionally prey upon little birds. The larger species of winged insects form their chief subsistence; and, as they do not prey so much upon beetles as the shrikes do, but upon flies and other insects of more lofty flight than the beetles have, they occupy a more elevated station in the forest. They are generally found perched on high stumps of trees, on the points of branches, and on other reconnoitring posts from which they can scan a considerable extent of the air; and the moment they discover an insect within the range of their vision, they dart upon it with great velocity, and generally unerring aim; seizing it with the bill after the manner of the swallow tribe. Though they do not hawk or beat the air on the wing like these, still there are many of them that approach slightly to the character of the martins, and are locally known by the same name. These usually have the tail forked, can turn in the air much more quickly than those which have the tail square or rounded; and the forked-tail ones are much more inhabitants of open places, though we believe that the greater part of the number build their nest in trees.

Most of them are migrant, or at all events discur- sive birds; and the nature of their food renders it necessary that they should be so. Some places of the tropical countries abound in insects, suited for the

nourishment of these birds at all seasons of the year; but such places are the close forests, and margins of the streams and marshes; and, wherever the ground is open, the violence of the drought sweeps away the food of such birds, and, consequently, the birds themselves are compelled to seek new pastures. But the birds are so abundant in every kind of locality, more especially in the American continent, and in some parts of Africa, that any attempt at describing their habits and localities, however meagre, would fill a large volume. We must, therefore, close our general observations, and proceed to some notice of the sub-genera, and a list of the principal species, with occasional short notices of a few of the more remarkable and characteristic ones.

TYRANNUS (*Tyrants*, or *Tyrant fly-catchers*). The species of this sub-genus are very numerous—the described ones amount to between sixty and seventy; and from the great extent of their native regions, which have not yet been explored, it is highly probable that there may be many species at present unobserved. As far as is known they are all natives of the American continent; and the greater number of them are found in the inter-tropical countries, though there are several which range considerably in latitude during the summer months.

The general characters are: the bill long, strong, and straight for the greater part of its length, but suddenly hooked, or bent near the tip. The culmen or ridge is straight or rounded. They are very brave and daring birds, and do not hesitate to attack the largest birds of prey, while they are bold, and generally successful in driving from their nests those birds which plunder the eggs and unfledged young. Those of the largest size not unfrequently prey upon small birds, as the shrikes do.

The Tyrant Fly-catcher (*Muscicapa tyrannus*), is probably one of the most characteristic species; it is found in the tropical parts of America, but ranges into the United States, and has been well described by Wilson, whose description we shall quote as being the most faithful, and at the same time one which applies in substance to several others of the species. "This," says the American ornithologist, "is the field martin of Maryland and some of the southern states, and the king bird of Pennsylvania and several of the northern districts. The epithet tyrant, which is generally applied to him by naturalists, I am not altogether so well satisfied with; some, however, may think the two terms pretty nearly synonymous.

"The trivial name king, as well as tyrant, has been bestowed on this bird for its extraordinary behaviour, and the authority it assumes over all others during the time of breeding. At that season, his extreme affection for his mate, and for his nest and young, makes him suspicious of every bird that happens to pass near his residence, so that he attacks without discrimination every intruder. In the months of May, June, and part of July, his life is one continued scene of broils and battles, in which, however, he generally comes off conqueror. Hawks and crows, the bald eagle, and the great black eagle, all equally dread a rencounter with this dauntless little champion, who, as soon as he perceives one of these last approaching, launches into the air to meet him, mounts to a considerable height above him, and darts down on his back, sometimes fixing there to the great annoyance of his sovereign, who, if no convenient retreat or resting place be near, endeavours by various

evolutions to rid himself of his merciless adversary. But the king bird is not so easily dismounted. He teases the eagle incessantly, sweeps upon him from right and left, remounts that he may descend on his back with the greater violence, all the while keeping up a shrill and rapid twittering, and continuing the attack sometimes for more than a mile, till he is relieved by some other of his tribe equally eager for the contest.

"There is one bird, however, which, by its superior rapidity of flight, is sometimes more than a match for him, and I have several times witnessed his precipitate retreat before this active antagonist. This is the purple martin, one whose food and disposition is pretty similar to his own, but who has greatly the advantage of him on wing in eluding all his attacks and teasing him as he pleases. I have also seen the red-headed woodpecker, while clinging on a rail of the fence, amuse himself with the violence of the king bird, and play *bo-peep* with him round the rail, while the latter, highly irritated, made every attempt, as he swept from side to side, to strike him, but in vain. All his turbulence, however, vanishes as soon as his young are able to shift for themselves, and he is then as mild and peaceable as any other bird.

"But he has a worse habit than all these; one much more obnoxious to the husbandman, and often fatal to himself. He loves, not the honey, but the bees; and it must be confessed, is frequently on the look out for these little industrious insects. He plants himself on the post of a fence, or on a small tree in the garden, not far from the hives, and from thence sallies on them as they pass and repass, making great havoc among their numbers. His shrill twitter, so near to the house, gives intimation to the farmer of what is going on, and the gun soon closes his career for ever. Man arrogates to himself, in this case, the exclusive privilege of murder, and after putting thousands of these same little insects to death, seizes on the fruits of their labour.

"The king birds arrive in Pennsylvania about the 20th of April, sometimes in small bodies of five and six together, and are at first very silent, until they begin to pair and build their nest. This generally takes place about the first week in May. The nest is very often built in the orchard, on the horizontal branch of an apple tree; frequently also, as Catesby observes, on the sassafras tree, at no great height from the ground. The outside consists of small slender twigs, tops of withered flowers of the plant yarrow, and others well wove together with tow and wool, and is made large and remarkably firm and compact. It is usually lined with fine dry fibrous grass and horse hair. The eggs are five, of a very pale cream colour or dull white, marked with a few large spots of deep purple, and other smaller ones of light brown, chiefly, though not altogether, towards the great end. They generally build twice in the season.

"The king bird is altogether destitute of song, having only the shrill twitter above mentioned. His usual mode of flight is singular. The vibrations of his broad wings, as he moves slowly over the fields, resemble those of a hawk hovering and settling in the air to reconnoitre the ground below, and the object of the king bird is, no doubt, something similar—viz., to look out for passing insects, either in the air or among the flowers and blossoms below him. In fields of pasture he often takes his stand, on the tops

of the mullein, and other rank weeds near the cattle, and makes occasional sweeps after passing insects, particularly the large black gad-fly, so terrifying to horses and cattle. His eye moves restlessly around him, traces the flight of an insect for a moment or two, then that of a second, and even a third, until he perceives one to his liking, when, with a sweep, he pursues, seizes it, and returns to the same spot again to look out for more. This habit is so conspicuous when he is watching the bee-hive, that several intelligent farmers of my acquaintance are of opinion that he picks out only the drones, and never injures the working bees. Be this as it may, he certainly gives a preference to one bee, and one species of insect over another. He hovers over the river sometimes for a considerable time, darting after insects that frequent such places, snatching them from the surface of the water, and diving about in the air like a swallow, for he possesses at will great power of wing. Numbers of them are frequently seen thus engaged for hours together over the rivers Delaware and Schuylkill in a calm day, particularly towards evening. He bathes himself by diving repeatedly into the water from the overhanging branches of some tree, where he sits to dry and dress his plumage.

"Whatever antipathy may prevail against him for depredations on the drones, or, if you will, on the bees, I can assure the cultivator, that this bird is greatly his friend, in destroying multitudes of insects, whose larvæ prey on the harvests of his fields, particularly his corn, fruit trees, cucumbers, and pumpkins. These noxious insects are the daily food of this bird; and he destroys upon a very moderate average, some hundreds of them daily. The death of every king bird is, therefore, an actual loss to the farmer, by multiplying the numbers of destructive insects, and encouraging the depredations of crows, hawks, and eagles, who avoid as much as possible his immediate vicinity. For myself, I must say, that the king bird possesses no common share of my regard. I honour this little bird for his extreme affection for his young; for his contempt of danger, and unexampled intrepidity; for his meekness of behaviour when there are no calls on his courage, a quality which even in the human race is justly considered so noble.

"This bird is generally known from the Lakes to Florida. Besides insects, they feed, like every other species of their tribe with which I am acquainted, on various sorts of berries, particularly blackberries, of which they are extremely fond. Early in September they leave Pennsylvania on their way to the south."

This very interesting bird is about eight inches long, and one foot two inches in the expanse of the wings. The general colour on the upper part is dark bluish ash, the head and tail being nearly black; but the tip of the tail is white, and it is square at the end. The wings are brownish, with dull white margins to the quills and coverts. The general colour on the under part is pure white; but the breast is pale ash colour. The plumage on the top of the head, though not forming a regular crest, is capable of being erected; and when it is so, it displays a rich tint of flame colour; and it is from this that the bird gets its kingly name. The bill is of a black colour, very broad, and with the tip of the upper mandible descending over the under one, furnished with a lateral notch, and beset with bristles at the base. The tarsi and toes are black streaked with grey, and the irides

hazel. The female has the upper part inclining to brown, less white on the tail, and the top of the head dull orange. The young in their first plumage have no orange on the crest.

The Great Crested Tyrant (*T. crinatus*) is another American species found in the tropical parts, and also in the temperate. It is rather longer in the body than the former species; but less powerfully winged, and in all its character a less bold and dashing bird. The general colour on the upper part is dark greenish olive. The feathers on the head are produced and pointed, forming a loose crest, dark brown in the centre of each feather, but paler and ragged at the sides. The throat and upper part of the breast are delicate ash colour, and all the rest of the under part sulphur yellow. The wing coverts are pale fawn colour, and the primaries bright russet, marked with bands of white. The tail is of the same colour as the primaries, and slightly forked. The bill is very like that of the first mentioned species; and the tarsi and toes are bluish black. The female is very similar to the male in appearance. "The bird now before us," says Wilson, "is less generally known than the preceding, being chiefly confined to the woods. There his harsh squeak, for he has no song, is occasionally heard above most others. He also visits the orchard; is equally fond of bees; but wants the courage and magnanimity of the king bird. He arrives in Pennsylvania early in May, and builds his nest in a hollow tree deserted by the bluebird or woodpecker. The materials of which this is formed are scanty and rather novel. One of these nests, now before me, is formed of a little loose hay, feathers of the guinea fowl, hogs' bristles, pieces of cast snakes' skin, and dogs' hair. Snake skins with this bird appear to be an indispensable article, for I have never yet found one of his nests without this material forming a part of it. Whether he surrounds his nest with this by way of *terrorem*, to prevent other birds or animals from entering, or whether it be that he finds its silky softness suitable for his young, is uncertain; the fact, however, is notorious. The female lays four eggs of a dull cream colour, thickly scratched with purple lines of various tints, as if done with a pen."

The Small Green-crested Tyrant. This bird is also a native of America, and ranges into the United States during the summer season. It inhabits the deepest, thick shaded, solitary parts of the wood; sits generally on the lower branches; utters every minute or so a sudden sharp squeak, which is heard a considerable distance through the woods; and, as it flies from one tree to another, has a low querulous note, something like the twitterings of chickens nestling under the wings of the hen. On alighting, this sound ceases, and it utters its notes as before. It arrives from the south about the middle of May; builds on the upper side of a limb, in a low swampy part of the wood, and lays five white eggs. It leaves about the beginning of September. It is a rare and very solitary bird, always haunting the most gloomy, moist, and unfrequented parts of the forest. It feeds on flying insects, devours bees, and in the season of buckberries, they form the chief part of its food. Its northern migrations extend as far as Newfoundland. The length of this species is five inches and a half; breadth, nine inches; the upper parts are of a green olive colour, the lower pale greenish yellow, darkest on the breast; the wings deep brown, crossed with two bars of yellowish white, and a ring of the

same surrounds the eye, which is hazel. The tail is rounded at the end; the bill is remarkably flat and broad, dark brown above, and flesh colour below; legs and feet, pale ash. The female differs little from the male in colour.

Such is all the specimen we can afford to give of this exceedingly numerous genus of birds. We have taken our materials chiefly from Wilson, and these of course refer to those species which reach the United States on their summer migrations. In tropical America they are very abundant; and there are considerable diversities both in size and colour, and in the form of particular parts of the structure, especially in the termination of the tail, which is much forked in some, square over in others, and in others again rounded or wedge-shaped. These differences indicate a considerable degree of dissimilarity in some of the habits of the birds; but except as regards difference of size, and locality as being more woodland, or more a frequenter of the open places, the distinctions between them are not of very great interest; and though their history were as complete as it is imperfect, their number would preclude us from going into the details of them, therefore we must pass into the next sub-genus.

MUSCIPETA (*Fly-hunters*). These inhabit a different region of the world, being found only on the old continent, in Asia or Africa. There are, indeed, some species found in New Holland, but they differ from the rest in the structure of their bill. This genus is however, not very definitely arranged, the birds which are included in it differ more from each other than those of the former; and therefore it is by no means easy to determine what species ought or ought not to belong to it.

The general characters are: the bill long, and very depressed; the breadth being double the height even from the base, the culmen flat and rounded, but notwithstanding it is flexible in many species, the margins of the bill are a little curved, and there is a slight notch near the point. The base is furnished with long bristles. The feeble and flexible nature of the beak restricts them almost entirely to vegetable food, as they are unable to divide any animal or vegetable substance which has any degree of toughness or hardness. To compensate for this want of power, they are furnished, in many of the species, with floating feathers, of which those of the former sub-genus are, generally speaking, destitute. These are attached to various parts of the head, but generally speaking they consist of produced feathers in the tail, or handsome crests on the head; and in general the colours of their plumage are more rich and gay than those of the tyrants.

The greater number of those which may be regarded as the most typical, or at least as the ones upon which the sub-genus is more directly founded, are, as has been already said, natives of Africa and the south of Asia. There are, however, some species in New Holland, and some others on the American continent, which resemble the typical ones in many of their characters; but they have at the same time some which are peculiar to themselves, and therefore they should perhaps be separated as a further sub-division of this portion of the family. The New Holland ones are remarkable for the breadth and flatness of their bills; and the American ones are characterised by much greater length of the tarsi and shortness of the tail, than any of the characteristic species. We shall mention one or two of the leading ones.

Muscipeta Paradisi. This species has been called by various names, such as the Paradise fly-hunter, crested long tailed pie, pied bird of Paradise, and a number of others. It has a bluish-green crest on the head. The body is white; the tail wedge-shaped, with the two middle feathers much produced in the male birds, but considerably shorter in the female. The body measures about six inches in length, and the tail fourteen. It is, however, very liable to vary; for it occurs of smaller dimensions also, with most of the upper parts pale-chestnut, likewise with the breast bluish-ash. Hence it has been thrice described by Brisson under different designations; and hence the *Muscicapa Paradisi*, and the *Turdus Paradisiacus* of Gmelin, are both females of the present species. Klein mistook it for a crested thrush, Mohring for a *Monedula*, and Linné for a *Corvus*. It is a native of the Cape of Good Hope, Bengal, and Madagascar, where it haunts the mangroves, or the borders of rivers. Most of this genus, or subgenus are, indeed much more frequenters of the humid parts of warm countries than the genus *Tyrannus*, so that they are much more resident in the same locality, and live more exclusively upon insects.

The *Royal Fly-hunter* (*Muscipeta regia*), which has been described as the royal tody, the king of the fly catchers, and various other names, is a very handsome bird. It is brown on the upper part, and white with lines of brown on the under. The crest is spreading, and stands over the head like a parasol, the general colour brown, but the tips of the feathers black, the chin and eyelids are white, the bill brown, and the legs flesh-colour, the length of the bird is about seven inches. It is described as being one of the South American species; but it inhabits the depths of the forests and is rarely seen.

The *Miller Fly-hunter* (*M. pristinaria*) is a small species about the same size as the Cape tit. It is of a reddish brown colour; and inhabits southern Africa, where it gets the name of the miller, from the male making a constant clicking sound like that of the "clack" of a corn mill.

The species of these birds distributed over the richer and warmer parts of the world, are very numerous, and some of them are so rich in the tints of their colour, and so gay in their produced feathers, that they have, in many instances, been confounded with the birds of paradise, from which, however, they are quite distinct, both in their structure and their habits. They have also been not unfrequently confounded with the *todies*, from which they differ widely, as these last are syndactylic birds, having some affinity with the kingfishers, and none at all with any of the fly-catching family. Their numbers are so many however, and their history is so complicated and so imperfect, that we cannot enter further into detail.

Platyrhynchus, which have the bill considerably larger and broader, should perhaps be made either a separate sub-genus, or a section of the present one. The greater number of them inhabit the warmer parts of America. They are numerous, but there are few materials for any particular description of them.

Those which have the tarsi long and the tail short, inhabit nearer the ground, and use their feet much more than the others; and they in some of the species, which are not very numerous, approach to the character of the thrush.

MUSCICAPA, or the fly-catcher properly so called, has, like the rest of the family, the bill considerably

depressed, but it is not so broad in proportion, and the upper mandible has a prominent ridge on the culmen. The upper mandible is hooked at the tip, and generally much notched. There are strong hairs at the base of the bill, which partly cover the oval, basal, and lateral nostrils. The tarsus is about the same length as the middle toe, and the outer and inner toes are, generally speaking, of the same length with each other.

The species of fly-catchers, as enumerated in the books, are very many; but as it does not appear that the sub-division formed by Cuvier, has been very correctly applied to them, it is not very easy to say which, especially of the less known ones, should be taken into the list, and which excluded. Indeed the difference upon which Cuvier's sub-division is founded, is sometimes so light, and the softer billed species are so apt to have the forms of their bills altered before they are placed in Museums, that the drawing of exact lines of distinction among so many, would be no easy task. The probability is, that the true fly-catchers are all inhabitants of the eastern continent or the eastern islands, while the American ones, whatever names may be given to them, belong rather to the sub-genus *tyrannus*.

In Europe it is the general habit of those birds to be migratory; and though some of them range pretty far northward upon the continent, they are confined to the south east of the British islands. The reason of this is perfectly obvious, and it throws some light upon the real cause of migration in birds. The climate of Britain is warmer than that of continental countries; but the northern parts of Britain do not range into nearly so high latitudes, as those of the continent; and they contain fewer woods and marshes, and are thus less favourable to the production of insects. So striking is the difference in this respect that, while the damp forests and margins of the streams in Lapland, within the polar circle, are literally pestered with insects during the summer, to a degree little short of what prevails in the damp forests of tropical America, one may traverse the bare hills and even the banks of the streams of the north of Scotland a whole summer's day, without seeing a single fly. The account given is highly improbable, and partakes not a little of that romance and credulity which attach so much to the regions of the north; but it has been stated by authors who can be supposed to have had no intention of misleading their readers, that those birds winter as far to the north as Lapland, though there is no well authenticated account of the same species even summering in Britain as far to the northward as the most genial parts of Scotland.

There are several fly-catchers which visit Europe, and two at least which make annual excursions to the British islands. The two British species are the spotted fly-catcher *Muscicapa grisola*, and the pied fly-catcher *Muscicapa atricapilla*.

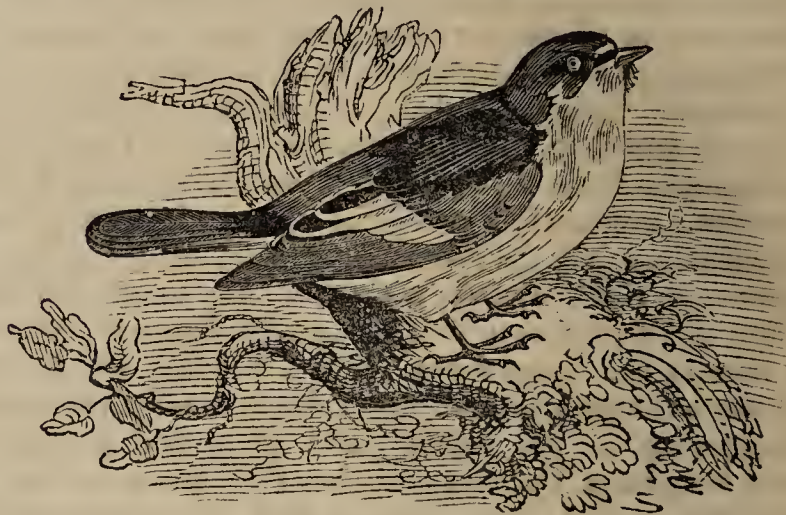
The *spotted Fly-catcher*. This bird arrives late in the British islands, seldom till near the month of May; and it departs generally in September. It is about six inches in length; brownish on the upper part, with a trace of red on the shoulders, a pale streak over the eye, the crown of the head spotted with darker brown, and the quills and tail feathers very dark. The under part is brownish, with dusky shafts to the feathers on the breast, and dusky spots on their webs. The bill is dusky; the sides hazel, and the

tarsi and toes, the former of which is rather short, are black. It resorts only to the rich and cultivated parts of the country, and is not found in open places or in the uplands. It is a very familiar bird, and appears to court the neighbourhood of houses, which indeed are obviously the places where its insect food is most abundant; and as it lives on winged insects and not on the caterpillars, it does not arrive so soon as those birds which feed chiefly on the latter; and it also quits the country early, because, as autumn sets in, such insects as are left, unless they are very small ones, are found near the ground; and though this bird comes near houses, its habit is to seek for its food in the free air. This food, which consists chiefly of dipterous or two winged insects, is captured as they cross the perch of the bird, so that it is a liar in wait, and springs upon its prey, instead of giving them chase upon the wing, as is the case with the fly-hunting bird. In the northern parts, it is rare; and not very abundant, except at favourite spots even in the south of England, but is very plentiful in the south of Europe. During the breeding season it frequently makes its nest in wall trees, or in the holes of old standard fruit trees, and if other circumstances do not favour it, it does not hesitate to place its nest on the ends of beams and rafters in outhouses; on these accounts it is called the beam-bird, the rafter-bird, the bee-bird, and a variety of other local names.

From their partiality to gardens and orchards, they have been regarded as destroyers of fruit. It is a prevailing notion in the county of Kent, that they suck the cherries; but individuals who have daily watched their proceedings in the French orchards, could never perceive that they attacked that fruit, though frequently allured to the trees by the presence of insects. By sudden jerks and turnings they will often lay hold on one of the latter that seemed to have eluded their pursuit; but in general they appear to be shy, melancholy, and stupid birds. Their nests, which are laboriously constructed, and which they seem to be little careful of concealing, are by no means models of neatness. The materials are generally vegetable fibres, moss, wool, &c., interwoven with spiders' webs, and lined with wool; and the situation is in trees or bushes, or the limb of a fruit tree nailed to a wall, in holes in the walls of out-buildings, or on the end of a beam, rafter, &c. The eggs are four or five in number, and not unlike those of the redbreast, being bluish white, with rust-coloured spots, but the latter more distinct, and not so much confined to the larger end, where, however, they are of a deeper tint. Both sexes share the care of incubation. When the young leave the nest, they are conducted by the parents to some neighbouring wood or grove, where insects abound, and where they may be seen darting, in every direction, in pursuit of flies. As the note of this species is a simple weak chirp, seldom uttered till the young have fled, the bird is more readily discovered than the redstart and other summer migrants, which, perhaps, are less common. The spotted fly-catcher has been frequently noticed in Cornwall and Devonshire. A correspondent of London's Magazine of Natural History had a nest of this bird brought to him, which he describes as follows: "It was built upon a wooden rake, that was carelessly lying on the ground in a cottage garden at Bransford, near Worcester; in this nest the female laid five eggs, and even sat on them indifferent to any one passing in the garden, till the nest was taken by a boy belonging to

the cottage. The nest is carelessly put together, yet prettily constructed of long green moss, intermixed with the catkins of the hazel, and fibres, the interior lined with thin straw and wool; eggs thickly spotted with brown."

The Pied Fly-catcher (*Muscicapa luctuosa*). This is a more handsome bird than the former, and more energetic in its manners. Its bill is of firmer struc-



Pied Fly-catcher.

ture, and it altogether approaches more near in character to the shrikes, than any of the other fly-catchers do with which we are familiar in this part of the world. An argument has been raised among naturalists whether this species be or be not a permanent inhabitant of the British islands; but it does not appear that there is much argument in favour of their residence during the winter. As summer migrants they frequent a different part of the country, keeping more inland and upland than the spotted species, and ranging along the western slope of the central elevation of England as far as Cumberland. It is worthy of remark that this bird follows nearly the same ground as the red-backed shrike, the species which, perhaps, it most resembles out of its own genus. In size it is nearly equal to the linnet; and its colours, which are subject to very remarkable seasonal changes, may be thus described, with a passing remark, that in almost all the fly-catchers with which we are well acquainted, and which are migratory, the winter plumage of the two sexes is very similar, while the summer plumage of the male bird varies much from the winter, and that of the female undergoes little or no change. The bill black, the irides of the eyes hazel, the front of the head white, the crown of the head, cheeks, eyes, and the whole of the upper parts, black, the smaller wing coverts, and the greater coverts of the primores are dusky; the six first quill feathers, wholly dusky, the rest white at the base, increasing till the three last feathers are wholly white, except a spot of black near the point of the exterior web; the upper parts of the bird, from chin to tail, are white, the tail is dusky black, the two exterior feathers white on their outer webs, and near the shaft on the inner webs, except at the point; the legs are black. The female has no white on the forehead; the whole of the upper parts are dusky brown, the under parts are dirty white, and in the wings the white is less conspicuous than in the male.

The following facts, given by Selby, are calculated to throw considerable light upon the characters of this bird. "Its mode of life, and the species of food upon which it subsists, also militate against the idea of its wintering in this island, for, living entirely upon winged insects, it would be impossible for it to pro-

cure any adequate supply of food, during the severity of the winter season. I should even be inclined to consider the few individuals met with in England during the summer, as birds that have been driven rather out of the regular track of their polar migration; and the following fact goes far towards confirming this supposition:—In May, 1822, after a very severe storm of wind and rain from the south east, several of these birds made their appearance in Northumberland, and I procured specimens of both sexes, the males being in different states of progress towards the summer's plumage. As the weather continued cold for some days subsequent to their appearance, they were obliged to resort to dunghills, and other warm situations, for a supply of their natural food. After remaining for about a fortnight to recruit their strength (for at first they exhibited great weakness), they all disappeared; nor could I ascertain that a single pair remained in that neighbourhood during the season of incubation. Their manners, flight, and method of catching their prey, were similar to the preceding species; and they were generally mute. The West Riding of Yorkshire appears to be a district in which the Red Fly-catcher is oftener met with than in any other part of the island.—It breeds there in the holes of decayed trees, forming a nest of leaves, bark, and hay, lined with hair and feathers. The eggs are four or five in number, of a pale bluish-green colour."

This is the species called the *Beccafico* or "fig-eater" by the Italians; and in that part of Europe its flesh is held in estimation as an article of food.

The *Collared Fly-catcher* (*Muscicapa albicollis*) is even more remarkable than the last species, for the seasonal change of plumage in the male. In his winter plumage, the male is exactly like the female, namely, of a grey colour, with a white band across the wings, but his summer or nuptial plumage is very different from this. The colours are then pure black and white, very strikingly contrasted with each other; a cap on the head; the back, the wings, and the tail, are black; and the forehead, the collar, all the under part of the body, a large spot on each wing, and a small one within each external edge of the tail, is white. This is a small species, found in the dense forests of the central parts of Europe, where it nestles in the holes of trees, and is of very retired habits, and very rare, or at all events, very seldom seen. Indeed, it is probable, from the difficulty of exploring a forest, and from the fact that, within these few years, some permanently resident British kinds have been discovered, we are ignorant of many species which are in reality not rare in those places of concealment.

Such must suffice as a specimen of the true fly-catchers, for the species which inhabit Africa, Asia, and the Asiatic islands, are so very numerous that the list of their names would take up much space, and cause little information.

Gymnocephalus (Bald fly-catcher, or Bald tyrant). This is an American sub-genus, and has more resemblance to the tyrants than to the true fly-catchers; but there are some doubts whether it should be classed exactly in this part of the system or not. Only one species is known: it is a large bird about the size of a crow. The general colour is reddish brown with a paler tint of the same on the under part. The front and nape in the mature bird are nearly naked of feathers; but they are feathered in the young with slender grey feathers, having their points white. The bill,

though considerably compressed, is angular and much stronger than that of most of the present group. This form of the bill, with the size of the head, and its resemblance to the other members of Vieillot's genus *Coracina*, would tend to the conclusion that it is a carrion bird rather than an insect feeder. But very little is known of its habits. It is a native of the dense forests in the interior of tropical America, and has been but rarely seen in its native habitat.

Cephalopterus has also been placed in the genus *Coracina* by Vieillot. As is the case with the former there is only one known species of this, a native of the forests on the banks of Amazon. It is about the same size as the former, but differing from it in colour. The general plumage is black, with purple and green reflections. There is a plume of loose and floating feathers on the top of the head, which form a sort of shade or awning over the front, and are variegated with black and white. There is also a membranous production of the skin of the throat, but with feathers in branches, which hang as a sort of detached gorget. The skin, which is partially seen through these feathers, is blue; the habits are as little known as those of the former; but, from the appearance, it is probable that, like the other, it is a carrion bird, and not an insect feeder.

FLYING-FISH (*Exocoetus*), a very singular genus of soft-finned fishes, with abdominal fins; and placed by Cuvier in the pike family. They have, however, sufficient peculiarities of character to entitle them to some notice in a separate article. The most remarkable part of their structure is the great length of the pectoral fins, which are pointed, something after the form of the wings of those birds which can skim swiftly over the surface of the waters; and they are capable of being expanded by the separation of the rays, and the consequent stretching of the connecting membrane.

Their characters are: the head and body scaly, with a row of earinated scales upon each side; their head is flattened on the upper part and the sides; the dorsal fins, situated immediately over the anal, and both are considerably produced, directed backwards at both commencement and termination, straight on their margins, of nearly equal length throughout, and about equal to each other. Their ventral fins are placed in advance of the centre of gravity, broader at the extremity than the insertion, and having their extremities concave. Their eyes are large; their under jaw is the longest; both jaws have fronted teeth, and they have flattened teeth on the pharynx. They have six arches in the gills, and are furnished with air-bladders of copious size.

Though from their structure they are classed in the natural family as the pike, their characters and situation in the waters are very different from those of that voracious fish. The pike lives the tyrant of the fresh waters, capable of not only preying upon every other fish which resides in them, but sometimes assailing the aquatic birds, even the large ones, and also the mammals which come to drink. There are no very authentic accounts of how matters stand as to mastery between the pike and the otter; but it is possible that even there, the pike may be able to keep his ground. The pike is thus a master; but, though a powerful, far from a handsome one; and in the dull and stagnant waters in which he chiefly resides, he appears to be the principal one appointed for keeping down the numbers of all the rest to the supply of food.

The flying-fishes are, on the other hand, small and feeble ; and though, at first sight, the extraordinary development of fins with which they are provided might seem to give them some certainty of escape, it rather appears that they are thereby placed in double danger. The form of their body is, no doubt, well adapted for swimming ; but it is questionable whether the great size of their fins may not, upon the whole, be an impediment to them in making their way through the waters. The form of the dorsal and anal fins must, by preventing the lateral motion of a considerable length of the body, lessen the effect of the anal fin in projecting them along. How the large pectorals may act in swimming, it is not easy to say, though they cannot, to any very great extent, produce progressive motion, and seem more likely to hinder it. At any rate the flying-fish is the constant prey of all the voracious fishes which range over the surface of the wide seas of the warm latitudes, in which only or chiefly flying fishes are found. Their power of leaping into the air, and sustaining themselves there for the space of more than half a minute, and in no instance probably exceeding, or even amounting to two hundred yards in distance, is not calculated to save them ultimately from their aquatic enemies, while it certainly exposes them to new enemies in the air ; for, when they rise in shoals, as they often do, the predatory birds, which are constantly ranging over the same seas, make prize of numbers of them ; and it is very probable that, as is the case with salmon when they leap, on being nearly overtaken by seals or porpoises, the flying-fish fall much nearer to their pursuers, than they are when they leap out of the water. Indeed, when the flying-fishes leap out of the water, it is generally observed, if the observer is near enough, that there is a shoal of coryphenes driving them along, very much in the same way that porpoises drive salmon ; and, as the exertion of the leap, and the exposure to the air, which is not their natural element, must jointly tend to weaken them : and farther, as they must require some time after their fall, before they can adjust themselves to the water, so as to have the same command of their swimming apparatus that they had when they quitted it, this must farther help to make them a more easy prey.

Though these fishes can project themselves to the height of fifteen or twenty feet above the surface of the water, and take such a direction in their leap as can carry them to a horizontal distance of a hundred and fifty or two hundred yards, it is quite a mistake to call the motion "flying," or the animals which perform it "flying-fishes." They are just as powerless in the air, and as incapable of making any effort there, as a wingless inhabitant of the land is. Their only power is in the water, and they can get no impetus of any kind but by acting against the water, as the point of resistance from which they are propelled. They are exactly in the situation of arrows shot at an oblique range. The force which urges them on acts only at the commencement ; and both the force of gravitation and the resistance of the air begin the destruction of it the instant they are in motion.

That there may be some advantages gained by the elasticity of the air reacting upon the fins and scales of a fish (and good leaping fishes are all scaly), we do not deny ; but it would be no easy problem to determine the amount or even the nature of this. It is also true that, as remarked by Cuvier, the produced and expanded pectoral fins of these fishes may prevent

their falling so rapidly as they otherwise would do. But even this acting like a parachute, and protracting of the fall, is a delivering of the fish up to an element which is not its own, and in which it is consequently quite helpless.

There is no organ that can act upon the air except a wing, and no wing can be moved but by means of pectoral muscles which have their fulcrum in a sternum of bone upon the under side of the animal. In birds the power of flight is always in proportion as the structure of skeleton supports the sternum, and in proportion as the muscles are concentrated upon this bone ; and even in those mammalia, such as the bats and a few others, which make a sort of grotesque and fluttering flight by means of an apparatus of this kind, there is always a provision bearing some resemblance to that organisation which works the wings of a bird.

In the flying-fishes, there is no such provision as this, no muscular structure by the action of which they can give their pectoral fins any motion bearing the slightest resemblance to that which wings have in flight ; the only effect of the fin being to diminish the rate and descent to the ground, in the same manner as a sheet of paper falls much more slowly, when its flat side is downward than when its edge is. The fins are, in fact, just as passive when the fish is in the air, as the sheet of paper is when it is let fall with its flat side in the position which has been stated. The arrangement of the muscles in those fishes does not differ from that of the rest of the class ; and though the fins are larger and a little different in their situations, there is not much more enlargement of bone, or provision for motion in the fins in a flying-fish than in any other. There is even less concentration of the fins in those fishes, than there is in some of the species which inhabit the bottom of the waters, and never by any chance come to the surface ; for though the ventral fins are placed farther forward than they are in many fishes, they are still abdominal fins, and not articulated to the bone of the shoulder as is the case with the ground fishes.

We are therefore to regard the flight, as it is termed, of these fishes as merely a leap, the whole exertion producing which is performed by their action on the water, and on the water alone ; and though, as is the case with any other body which is projected obliquely, they rise upward in a curve, and fall less vertically than they rise, in consequence of the wings acting as a parachute, they are just as much at the mercy of the air as any other passive substance which can be projected into it.

We have felt it necessary to state at some length the utter impossibility of these fishes being in any respect air animals, or real fliers, in consequence of the many absurdities respecting them which are found in most of the books of popular description. In these it is represented that they not only can turn to the right or left while they are in the air, but that they can ascend and descend, so as to accommodate themselves to the waving surface of the sea, and thus preserve an equal distance from the ridge and trough of the wave, as long as they are in the air. In this there is another deception which is not unworthy of notice, as illustrative of the real phenomena of the sea. The motion of the waves, though they appear to roll onward before the wind, is not a progressive motion of the water, but a mere vibration of the surface, the wave swinging on the centre of its elevation in the same manner as a pendulum swings on its point

of suspension, and following exactly the same law, so that if the total height of the wave is between 66 and 67 inches, it will vibrate seconds with the same accuracy as the pendulum of a clock; that is, each part of it will take one second to come to the level, and of course an equal time to shift from above to below, or from below to above. This motion of the surface of the water must cause a corresponding undulation of the air over the surface; and if any object whatever is simply floating in the air, and supported by that, without any exertion of its own, it must of course undulate along with it. The flying-fish is supported in this manner, and therefore when the air in which the fish is, sinks down following the trough of the sea, the fish must sink down along with it; and so also when the air is raised up by the other part of the motion, or the elevation of the ridge, that the fish must be upheaved along with it is therefore perfectly evident. There is no question that those motions of the sea, communicated to the air, and by the air to the flying-fish, which simply floats in it, may give the fish an apparently undulating, or alternately an ascending and descending motion both in its ascent and its descent to those who observe it looking endways on the waves; nor is there any doubt that this is the real cause which has led the popular describers into the blunder with regard to their ascents and their descents.

On the general subject of flying-fishes we shall take the liberty of quoting a passage from Mr. Yarrell's very scientific work on British fishes, now in the course of publication. "The most recent observations on the habits and powers of the flying-fish are those by Mr. George Bennett, the author of *Wanderings in New South Wales* and other countries, who appears to have devoted particular attention to the subject. 'I have never,' observes this gentleman, 'been able to see any percussion of the pectoral fins during flight, and the greatest length of time that I have seen these volatile fish on the fin has been thirty seconds by the watch, and their longest flight, mentioned by Captain Hall, has been two hundred yards, but he thinks that subsequent observation has extended the space. The most usual height of flight, as seen above the surface of the water, is from two to three feet; but I have known them come on board at a height of fourteen feet and upwards; and they have been well ascertained to come into the channels of a line-of-battle ship, which is considered as high as twenty feet and upwards.'

"But it must not be supposed they have the power of elevating themselves in the air, after having left their native element; for, on watching them, I have often seen them fall much below the elevation at which they first rose from the water, but never in any one instance could I observe them raise themselves from the height at which they first sprang; for I regard the elevation they take to depend on the power of the first spring or leap they make on leaving their native element.'

"The writer of the supplementary part to the class Fishes, in Mr. Griffith's edition of Cuvier's *Animal Kingdom*, agrees with Mr. George Bennett. He states that the flying-fishes rise into the air by thousands at once, and in all possible directions. Their flight, as it is called, carries them fifteen or eighteen feet out of the water; but it is an error to call them flying-fishes, they do not in reality fly, they only leap into the air, where they have not the power of sus-

taining themselves at will. They never come forth from the water except after a rapid course of swimming. When put alive into a vessel of sea-water, in which there was not sufficient space to acquire momentum, they were only able to rise out of it a few inches. The lines which they traverse, when they enjoy full liberty of motion, are very low curves, and always in the direction of their previous progress in the water.

"The recent observations of both these writers confirm the view taken by Cuvier of the powers of flying-fishes, as described in the *Règne Animal* of that author; who, using the words flight and wings figuratively only, says, 'their flight is never very long, and their wings (fins) only serve them as parachutes.'

"The flying-fishes themselves feed on mollusca and small fishes. Their flesh has an agreeable flavour, and is often eaten by mariners on long voyages."

We have quoted these paragraphs because they embody the testimonies of eye-witnesses, and are selected by one who is not likely to be imposed upon by fanciful theories. At the same time, we do not think any appeal to the facts necessary in this particular case, inasmuch as there is quite enough in the structure of these fishes to establish the truth of their being incapable of flight, that is, of giving themselves a new impulse from the air as a fulcrum. Some have pretended to say that they fly by means of the humidity of their pectoral fins, and fall in the water only when these become dry; but this is an absurdity which carries along with it its own refutation. That there is a certain capillary attraction between water and air is perfectly true, but the degree of this attraction is not sufficient to suspend in the air any body, however light, as may be ascertained by any one who chooses to wet any substance whatever, and commit it to the air. Its rate of falling in such a case will not be found to be materially affected by the wetting of its surface, and in the case of a substance lighter than water it will be found that the wetting makes it fall faster. There is as little truth in the notion that these fishes buoy themselves up in the air by means of any membrane connecting the fins which they extend as a sail, that is, they acquire, and can acquire no new impulse from any such contrivance, even granting that they were in possession of it. They are fairly committed to the atmosphere, in which they have not the slightest means or power of action, and thus they can remain in the atmosphere no longer than the force with which they originally project themselves from the water can sustain them.

If it were not for the peculiar form and the elongation of their fins, the flying-fishes have a good deal of similarity to the herring. They are also of a silvery lustre, and have a very brilliant appearance when a cloud of them leap simultaneously into the air. In the warm seas those displays are exceedingly common; and after ships from this country have made so much "southing" as to gain the trade wind or nearly so, these fishes and their enemies of the sea or of the air are among the most interesting phenomena of the steady and comparatively tranquil voyage. These fishes rise from the surface of the water in crowds as much thronged, and projected along with as much velocity as flocks of birds when they rise from a stubble field. But though this sight is a lively and exciting one, even it shows that they then are out of their element, or in terms of the common expression, "fish out of the water." When the flock of birds rise, they

either all rise in the same direction, or they soon acquire it; and though their motion be a horizontal spiral, or circular in the vertical direction, as it is in the flight of dotterels and some other species, they all keep course with each other. The motions of the flying-fishes are, on the other hand, perfectly irregular, and they proceed in all directions just as they happen to jerk themselves out of the water, evidently showing that when in the air they have no power in themselves, save what is derived from their simple gravitation, which at last brings them to the water upon the very same principle that it brings a stone downwards.

It would be by no means an uninteresting point in animal mechanics to find the peculiar action of the body by which those fishes raise themselves so far out of the water, and especially project themselves so far by one single exertion. We know from actual observation that salmon, trout, and other leaping fishes whose motions we can observe, leap by first curving the body to one side, and then unbending the curve by the exertion of the whole of their muscular energy; and as the body of a flying-fish is organised upon the same general principle, there is no doubt that the impulse is given to them in a similar manner, by the whole muscles being brought into vigorous play. How far the very long pectoral fins may act in elevating the fore part of the body, and how they may be assisted in this by the ventral fins, we cannot positively say; for the leap of the fishes from the water is too rapid for enabling us to observe it with so much minuteness as to be able to determine the action of the different parts. We know, however, that there are fishes which, by the action of the fins, can throw themselves to a considerable height, though this is observed chiefly in those mud fishes which leap from the oozy bottom at low water. When Captain King was surveying the north coast of New Holland, he found in some of the muddy bays, at low water, such multitudes of those jumping fishes that at first sight he imagined they were frogs; but even in the case of them, the impulse is given so suddenly that it is not easy to observe the manner in which it is performed, that is, to refer the different parts of it to the organs which more immediately produce them. In all fishes, however, the quantity of muscle bestowed on the body fins, to what part soever of the body they may be attached, is so very trifling, compared with what moves the spine and the caudal fin, that we must refer their principal action, whatever it may be, to this part of their structure; nor is there any thing in the flying-fishes which can make them an exception to this rule, there being no more accumulation of muscular substance, and consequently no more muscular strength, connected with that part of the skeleton to which they are attached, than there is connected with the same organisation of the bone in fishes which have these fins much less produced, and are incapable of projecting themselves to such heights and distances. We shall now give very brief notices of the leading species.

Exocetus volitans, the common flying-fish, is the one which is most common in the warmer seas of the northern hemisphere. It is met with in the greatest numbers from about the thirtieth degree of north latitude to the equator; but it is not altogether unknown in seas much farther to the north. In the Mediterranean, which has a much more tropical character than its latitude would lead us to expect, this singular fish is by no means uncommon, and it is as much

assailed there by the coryphæ as it is in the Atlantic, though we believe that when in the air it is much more safe from the bill of the albatross. This fish, besides the singular appearance given to it, by its greatly produced fins, has a stupid look, from the disproportionate largeness of its eyes; and it is not a little remarkable that, while the shape of its body is very much that of a surface fish, such as a mackerel, a herring, or an anchovy, its organs of vision should resemble in size those of the deep water fishes, which may be supposed to have much less light in their profound abodes than is enjoyed by the flying-fish near the surface. The length of the common flying-fish varies from six inches to a foot; its ventral fins are small, and placed in a medial situation between the upper part of the gill-openings and the vent; the scales upon it are large and easily removed, and the mouth is partially extended into a sort of tube. It is said that there is a variety in the Red Sea very much resembling this one in its general appearance, which has not the habit of rising from the water; and this renders it probable that this habit is one of necessity and not of choice; that it is an attempt to escape from enemies, and not a natural exertion for the procuring of any gratification to the fish in a state of peace and safety.

This is the species of which examples have occurred on the British shores, chiefly on the south and west; and as these are interesting from the celebrity of the fish, we shall again quote Mr. Yarrell for the instances of its occurrence. "Pennant states," says Mr. Yarrell, "that in June, 1756, one was caught at a small distance from Carmarthen, in the river Towy, being brought up by the tide, which flows as far as the town. Dr. Heysham, in his Catalogue of Cumberland Animals, prefixed to Hutchinson's history of that county, says, at page 32, 'Another flying-fish was seen at Allowby in September, 1796, by Mr. Chancellor Carlyle, when he was bathing; it was near the shore and upon the surface of the water, and came within a yard of him.' According to Dr. Fleming, another occurred in July, 1823, ten miles from Bridgewater, in the Bristol Channel, a notice of which was communicated to the Linnæan Society by the Rev. S. L. Jacob.

"The following letter appears in the fortieth number of the Royal Institution Journal, addressed to the editor.

"Sir—In going down Channel on the 23rd of August last, with light winds from the E. N. E., inclinable to calm, when off Portland, we were surprised by the appearance of a rather large shoal of what is commonly called the flying-fish. They were evidently closely pursued by some one of their numerous enemies, from the frequent and long flights which they took; but it was impossible to discover what that enemy was, though passing close to the vessel. The fact may possibly interest some of your numerous scientific readers.

"Sunderland, Dec. 2, 1825. J. C. W."

"From the manuscript of Mr. Couch, another instance may be quoted of a flying-fish, 'which threw itself on shore, on the sandy margin of Helford River, near Falmouth, at full two miles from the open sea, where it was found while yet living. I was informed by Mr. John Fox, at Plymouth, in whose collection this specimen was in 1828, that it measured sixteen inches in extreme length, and that the pectoral fin was eight and a half inches long; a size which caused

me to suppose it might be the *E. evolans*, of which I possess a specimen twenty and a half inches long. There can be little doubt that this fish had been chased out of its usual haunt by some one of those voracious inhabitants of the deep by which they are continually persecuted."

We have given this quotation from Mr. Yarrell's work at length, because we know that he is very particular as to his authorities; and the evidence which he has brought together renders it highly probable that more than one species of those curious fishes occasionally occur on the British shores, though so rarely and so incidentally that of course no one need directly look out for them, farther than by having their eyes about them, when they visit those parts of the coast where such fishes are most likely to be met with; and if they do this, they have a chance, indeed a certainty, of being repaid for their trouble, or rather the pleasure of using their eyes, whether they may happen to see a flying-fish or not.

As one of the distinctions of the different species of those fishes is the number of rays in the several fins, and as this is, we believe, very constant in each, we shall mention them. The present one has fourteen rays in the dorsal, fifteen to seventeen in each of the pectorals, six or seven in each of the ventrals, thirteen in the anal, and fifteen in the caudal.

Exocetus evolans. This species, which has been mentioned as sometimes occurring in the British seas, attains a larger size than the former, being sometimes as much as twenty inches in length. It is abundant in the Mediterranean, and when it can be captured it is excellent eating. It is also not unfrequent on the coasts of Spain. Its mouth has not the tubular form of that of the common flying-fish; its form is more nearly that of a herring, or rather of the sardine, its eyes are much smaller, and it is altogether a more handsome fish. The number of rays on its fins are thirteen or fourteen in the dorsal, thirteen in the pectorals, six in the ventrals, eleven to thirteen in the anal, and fifteen in the caudal, so that, though a larger fish, it is not so well finned, excepting in the tail, as the common flying-fish; and hence we are to conclude that though it is an equal swimmer, it is an inferior leaper.

Exocetus exsiliens. This species has not been found of exactly the same size as the last mentioned, though it has been met with larger than the common flying-fish. Its forehead is very elevated, and its ventral fins are pointed and placed nearer the tail than in the preceding species. Its anal fin is placed immediately under the dorsal, and is a little longer in the front portion than in the rear. It is represented as inhabiting both the Atlantic and the Indian Ocean, as being discursive, and found in the Red Sea, in the Mediterranean, on the coasts of Brazil, and as far north as the southern parts of the United States. The rays in its fins are ten in the dorsal, fifteen in the pectorals, six in the ventrals, eleven in the anal, and ten in the caudal.

Exocetus mesogaster is a species of the West Indian seas. The dorsal and anal fins have the form of a sithe-blade or falchion, which completely distinguishes it from all the others. Its ventral fins have six rays each, and its caudal twenty; those on the others have not been determined.

Exocetus Mitchellii. This species has been found on the American seas, and is described by Mitchell, in his account of the fishes of New York. Its head is

very like that of a herring, and the outlines of the dorsal and anal fins are nearly parallel to those of the body.

Exocetus Nutalli has been found in the Gulf of Mexico. Its pectoral fins are brown at the base, with two transverse bands, of which the first is forked on the outer side, and the ventral fins are marked with three brown spots. There are some other species of the division now under consideration which have been figured and described, but it is doubtful whether they may not be accidental varieties of some of those which we have noticed. All which we have hitherto alluded to have the muzzle and the lips plain, or without barbules or fibrous appendages; and we believe that most of them have been met with on both sides of Africa, though they are perhaps more abundant in the Atlantic than in the other oceans. There are a few other species, which have appendages to the mouth, and which are, we believe, so far as is known, peculiar to the American shores.

Exocetus comatus. This species has been observed on the shores of the United States. Its ventral fins are very long and pointed, and situated a little farther forward than in most of the others. Its anal is one half shorter than the dorsal; it has a long barbule attached to the under jaw, and the mouth is very small. The rays on the fins are, pectoral twelve, ventral six, anal six, caudal eleven.

Exocetus furcatus. This is found on the same shores as the former, but it is of smaller size. Its eyes are large and prominent, like those of the common flying-fish; its ventral fins, which are large, pointed, and marked with spots, are placed at the middle of the length. There is a barbule at each angle of the mouth, which extends, when stretched, as far as the base of the pectorals. This is rather a rare species, and the rays of its fins have not been counted.

Exocetus fasciatus. This species has been observed in the West Indian Seas, and it gets its trivial name from the brown bands or fascia which cross the pectorals. It has two long barbules on the under lip, the extremities of which are divided into three branches, the middle one longer than the other two. The rays in the fins of this species are, twelve in the dorsal, ten in the anal, eighteen in the pectorals, sixteen in the ventrals, and twenty in the caudal, from which last circumstance we may be led to infer that this species is the best swimmer of the genus.

We have no doubt that, besides those which we have mentioned, there may be many species of those singular fishes; and though they are not among the most interesting inhabitants of the sea in an economical point of view, we have been induced to notice them at some length; first, because of the singularity of their habits; and secondly, because, according to many of the published accounts of them, the functions which they are said to perform are inconsistent with their structure, for a real flying-fish is as much a creature of the imagination as a flying horse.

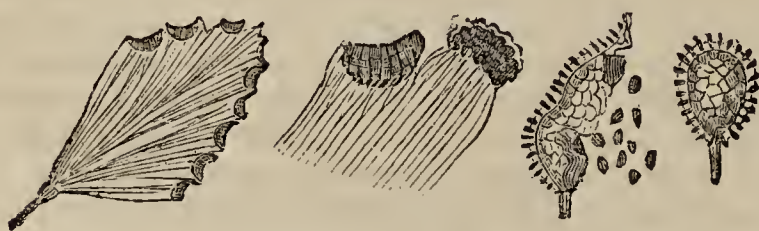
FODIA (De Blainville). A naked mollusc, one species of which has been described, but it is so little known, that the propriety of constituting a new genus of it appears problematical.

FŒNUMGRÆCUM, is the *Trigonella fœnum-græcum*, or common fenugreek of authors, an economical plant, found wild in many places on the continent.

FŒNUS (Fabricius). A remarkable genus of hymenopterous insects, belonging to the section

Terebrantia, and family *Evanidæ*, having the body long, the ovipositor long and protruded, the posterior shanks clubbed, and the fore wings with two sub-marginal cells. The abdomen, which is long and club-shaped in both sexes, is attached to the thorax close behind the scutellum, and, from its singular position, it is very much elevated in flight. The species, of which two only are found in this country (the *Sirex jaculator* of Linnæus being the type), have a good deal the appearance of ichneumons, which they also somewhat resemble in their economy, being parasites, feeding in the larva state upon other insects. They are found flying about sand banks, old walls and palings, prying into the holes and crevices with their antennæ, which, according to Bergmann, they employ for the purpose of searching for the latent grubs of certain bees, and other hymenoptera. In this respect, therefore, they seem to resemble the parasitic species of bees or sand-wasps; but it is more probable to suppose that they deposit their eggs in the bodies of the larvæ, instead of placing them at random in the cells. In the perfect state they frequent flowers, feeding upon nectar. They are often to be seen hanging upon plants by their jaws, in which position they take their repose.

FOLIACEÆ is the first class of the grand division *Cellulares*, containing the foliose and frondose ferns



Examples of the fructification of foliaceous ferns.

and their allies. It contains six orders, viz., *Filices*, *Equisetaceæ*, *Lycopodiaceæ*, *Marsileaceæ*, *Musci*, and *Hepaticæ*, described under their several titles.

FOOL'S PARSLEY is the *Æthusa cynapium* of Linnæus. A common British weed belonging to *Umbelliferæ*.

FORFICULA (Linnæus)—The Ear-wig. A genus of insects serving as the type of a distinct order, named *Dermaptera* by Leach and Kirby, and *Labidoures* by Léon Dufour, but regarded by Latreille as forming a section of the order *Orthoptera*. Having given the general characters, and detailed the economy of these insects, in the article EAR-WIG, we shall here only add, that, as a group, they are technically characterised by having the tarsi three-jointed; the lower wings fan-shaped, and very much folded; the wing-covers short, square, and uniting with a straight suture; the body linear; the head not concealed by the thorax, which is shield-shaped. M. Serville has lately established numerous genera, founded upon exotic species, resting solely upon structural characters. The following are the British genera:—

Forficula (Linnæus). Antennæ thirteen to fifteen-jointed; tarsi with the penultimate joint bilobed; wings two. Type, *Forficula auricularia* (Linnæus).

Chelidura (Latreille). Antennæ twelve-jointed; tarsi with the penultimate joint bilobed; wings none. Type, *Forficula albipennis* (Charpentier).

Labia (Leach). Antennæ ten to twelve-jointed; tarsi simple. *Forficula minor* (Linnæus).

Labidura (Leach). Antennæ about twenty-five jointed; tarsi simple. *Forficula gigantea* (Fabricius).

FORMICIDÆ (Leach.) An extensive family of hymenopterous insects, belonging to the section *Aculeata*, and to the sub-section *Heterogyna* of Latreille, comprising the Linnæan genus *Formica*, or the numerous tribes of ants. Referring to the article ANT for numerous particulars of a general and popular nature relating to these insects, we shall, in the present article, give the technical characters of the family and its chief genera, and add a description of a few of the more interesting species, with such of their peculiarities of economy as may appear desirable.

In addition to the great character derived from the existence of individuals of the female sex, whose organisation has been so modified that the insects become what are termed neuters, a peculiarity dependent, as we have stated in the articles ANT and BEE, upon the social character of the insects, the *Formicidæ* are distinguished by the wingless state of their abortive females (in which respect they are different from the bees and wasps, in which the neuters are winged), by the great length of the basal joint of the antennæ in the females and neuters, in which they are elbowed at the extremity of this joint, and by the first, or the first and second, joints of the abdomen being knotted; the upper lip of the neuters is large, horny, and perpendicular, falling between the jaws; the eyes are rounded, or oval and entire; the jaws are large in many of the species, the form of these organs varying greatly in various species. In their structural characters the *Formicidæ* approach nearly to the *Tiphidæ* and *Doryli*, belonging to the section of the sand-wasps. The neuters are much smaller than the males, and these are smaller than the females; the abdomen in the first and last of these sexes is composed, as in the other aculeate hymenoptera, of six segments, and that of the males of seven joints. The females and neuters are, moreover, furnished with a sting in many of the species. In those species which are destitute of a sting, the abdomen of the females is larger than that of those individuals of the same sex in other species which are provided with this instrument, but in the males it is always smaller. It is a curious circumstance, that the pupæ of those species which are furnished with a sting are inclosed in cocoons of a whitish colour, whereas the stingless species are not so inclosed. These cocoons are formed of numerous minute threads of silk, spun probably by the larva. Those species which possess a sting emit a venomous fluid into the wounds which they make, which occasions severe pain; whereas the stingless species emit a reddish transparent fluid, which they discharge upon the skin of the sufferer, causing painful pustules. This fluid, according to De Geer, is discharged from the anus; but other, and we should conceive less accurate observers, state, that it is emitted from the mouth; hence, probably, the supposition that the ants first make wounds by biting with their jaws, and then insinuate the poisonous fluid from the anus into the wound. Of the various genera into which this family has been divided by Latreille, Jurine, and others, the more remarkable are, *Formica*, *Polyergus*, *Ponera*, *Myrmica*, and *Atta*.

The genus *Formica* is distinguished by having the footstalk of the abdomen composed of a single joint the mandibles triangular and denticulated at the

edge; the females are destitute of a sting. This genus comprises about a dozen British species, the largest of which is the hill, or horse-ant, *Formica rufa* (Linnæus), confounded by some with the *Formica herculeana* of the same author. The neuters in this species are about one-third of an inch long, of a black colour, with the thorax, abdominal scale, and a large part of the head, red. Unlike the *herculeana*, which builds in the trunks of trees, the *F. rufa* makes its large conical nest in the open ground, in woods, amassing together large quantities of sticks, straws, earth, &c. The number of individuals of which one of these nests is composed is very great. On disturbing the nest, they sally forth in vast quantities, assuming a most threatening aspect, and biting powerfully with their jaws, retaining hold of whatever they may seize upon with the greatest pertinacity. This species, moreover, collects grains of wheat, barley, and other small seeds, which it indiscriminately adds to the stores of vegetable matters of which its nest is formed, which circumstance doubtless gave rise to the praise bestowed upon these insects for foresight in laying up food; but if this portion of their economy has not for its object the storing of a due provision during the winter months, as has been ordinarily supposed, on account of ants lying torpid during the winter, and consequently not feeding upon such supplies, it is not the less interesting when regarded in its proper light. The nest, which at first sight appears only like a confused mass of sticks and straws, laid without order, is nevertheless ingeniously contrived to throw off the rain, to defend it from injuries of the elements, attacks of enemies, or the heat of the sun. It has generally the appearance of a rounded dome, the woody parts of the building being the most elevated; the interior of the nest, however, is much larger, and extends to a considerable depth under ground. Here innumerable avenues are constructed, and a multitude of narrower passages, placed nearly in symmetrical order circularly, and extending to the base of the dome, and which are necessary for the free ingress and egress to the workers, which, unlike those of the other species, appear to prefer the broad light of the day, not fearing to execute their labours in our sight. But there is a portion of the economy of this species which is perhaps the most interesting, because not observed in the other species, in the nests of which there is but a single entrance, and which is so placed as to prevent the ingress either of rain or of enemies. In the *Formica rufa* this is not the case; the nest has an infinity of entrances, through which, during the night, whilst the insects are all quiet within the nest, the rain might enter in torrents, or they might be surprised by their enemies. Now, this is guarded against in a singular manner. Towards sunset the nest appears in a perfect bustle, but, if attentively examined, it will be seen that all this confusion, in which the shifting of the outer materials of the nest is apparently a source of disorder, has for its object the barricading of the passages, and which is at length completely effected, the insects shutting themselves within for the night. The mere outward appearance of the nest does not convey any idea of the manner in which the entrance of water is excluded by day. This, however, is so completely effected, that, even after long rains, the interior of the nest is not even found to be damp lower than a quarter of an inch from the outer covering. Our readers will remember

the account recorded in the Bible of the tasking of the Israelites in Egypt to make bricks, and the refusal of their taskmasters to supply straw, that article being employed, when cut in pieces, for binding together the mud of which the bricks were composed. The ants pursue the same mode in the building of their nest; the particles of earth laying between the layers of straw and bits of wood being moistened by the early rains, subsequently harden by the heat of the sun, forming a compact roof, which is again and again covered over, until the nest acquires its full size.

Another British species, *Formica sanguinea* (Latreille), is of a blood red colour, with the eyes and abdomen black, with the wings dusky at the base; the neuter is similarly coloured, except that the head is of a darker colour; and the male is black, with red legs. This species burrows in wood, and is one of those species which steals the young of other species, rearing them to perform the duties of the nest. See also POLYERGUS.

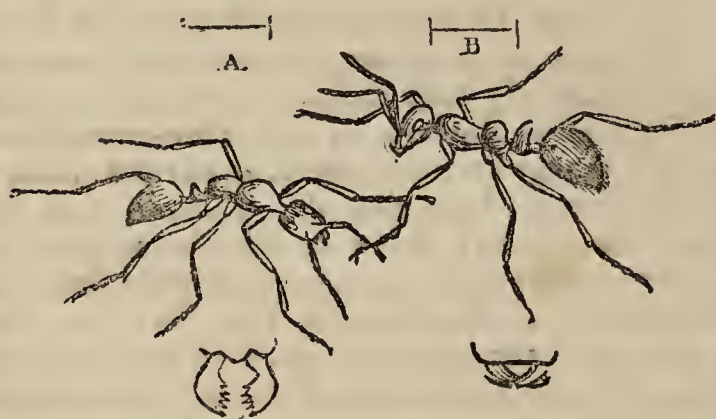
Two of the species subject to these marauders are the *Formicæ cunicularia* (Latreille), and *fusca* (Linnæus), both of which are inhabitants of this country. The latter species is of a shining black colour, with a slight ashy tinge; its form is rather long, and it is nearly smooth; the three or four basal joints of the antennæ are of a red colour, as are also the legs; the abdominal scale is large and triangular, and the ocelli are distinct. This species establishes its nest under stones, moss, &c., and at the foot of trees, the nest being almost entirely under ground. In the nest is often to be found the larva of a *Lamellicorn* beetle, probably that of a *Cetonia*, or *Melolontha*.

Amongst the exotic species of this genus are to be found many which are extremely injurious or annoying in their habits. Of these the sugar ant of the West Indies, *Formica saccharivora* (Linnæus), is perhaps the most extensively prejudicial. This species establishes its nest at the root of the sugar-canes, lime, lemon and orange-trees, where it excavates around the roots, thereby loosening the earth, so that the trees are either blown down by the violent gales in those parts of the world, or are so completely deprived of their supply of nourishment, that they soon die. Some years ago, the injuries committed by this insect were so great, that a reward of 20,000*l.* was offered by the planters to any one who should discover an effectual mode of destroying them, yet nothing could be found to stay their ravages. The aid of fire was even resorted to in vain, the insects rushing into the blaze in such myriads of millions, as to extinguish it. Vain was every attempt of man to effect their destruction, till, in 1780, it pleased Providence to annihilate them by torrents of rain.

The proceedings of another exotic species, *Formica indefessa*, of which an account has just been published by Lieutenant-Colonel W. H. Sykes, in the Transactions of the Entomological Society, exhibit one of the most extraordinary instances we have ever yet met with of the operations of that principle, or instinct, as it is called, "which enables an animal to do that which, in those things which man can do, results from a chain of reasoning, and in things which men cannot do, is not to be explained by any efforts of the intellectual faculties." The species in question was observed near Poonah, in the East Indies; and Colonel Sykes, after mentioning their fondness for saccharine matters, such as sugar-candy, preserved fruits, &c., relates the various modes by which they

succeeded in overcoming the obstacles placed in their way in order to secure those things from their attacks, swimming over the water, in which the legs of the tables were plunged, stepping, or rather jumping upon the tables, when removed to a short distance from the wall. Colonel Sykes proceeds: "The table was now removed from the wall beyond the maximum stretch of the largest ants, and I flattered myself I had triumphed over their perseverance and ingenuity, but, to my infinite surprise, in a few days the sweets teemed, as usual, with the intruders, and I was puzzled in no small degree to account for their re-appearance. Accidentally passing the table, I observed an ant upon the wall, about a foot above the level of the sweets; it fell, and, instead of passing between the wall and the table, and alighting upon the ground, the insect fell upon the table. Can it be possible, I said to myself, that this fall is designed? I stood to observe with the most intense curiosity; another ant ascended, and dropped with similar success; another and another followed; and there was no longer doubt that instinct (if instinct I must call it) had made them, in this instance, a match for reason."

The genus *Polyergus* (Latreille) is distinguished by having the antennæ placed close to the mouth; the jaws are slender and curved, the sting wanting, and the abdominal peduncle composed of a single joint. The type of this genus is the *Formica rufescens* (Latreille). This interesting species, although very common in France, has not yet been discovered in this country. At the present moment, however, a few particulars relative to the slave-trade amongst insects may not be thought uninteresting.



A, *Polyergus rufescens*. B, *Formica fusca*.

The indefatigable Huber, to whose researches upon this family of insects entomologists are so much indebted, was the first author who noticed the remarkable circumstances connected with their history. Walking in the neighbourhood of Geneva one afternoon, he observed a troop of these ants, eight or ten feet long, and three or four inches broad, crossing the path, and proceeding with rapid steps towards a nest of the *Formica fusca* above described. On arriving at its entrance, the latter (which are considerably smaller in size) attacked the strangers, but were soon put to flight, and retreated into their nest, pursued by the victors, some of whom commenced making another breach at the side of the nest, through which the remainder entered. In three or four minutes, however, the *Polyergi* returned in haste, each holding in its jaws a larva or a pupa; and, loaded in this manner, they succeeded in arriving at their own nest. On returning to look at the state of the pillaged nest, Huber found some of the black ants perched upon

the adjacent grass, each holding a larva or pupa, which it had saved from the pillage, and with which they soon returned to their nest. The next day, interested by this curious proceeding, our observer returned to the spot, and again witnessed a similar attack on another nest. Here, however, such of the victors as could not secure a larva or pupa, united in a body, and attacked a third nest, where they found an ample supply. On returning to the nest of the *Polyergus*, the surprise of M. Huber was infinitely increased at observing a number of the black ants themselves occupied upon and within the nest, and appearing to be on the most friendly terms with the *Polyergi* on their return from their marauding excursion, feeding them, and touching them with their antennæ, &c. Never, observes M. Huber, did riddle more strongly excite my curiosity than this singular discovery; and he fortunately succeeded in discovering some of the nests close to his house, so that he was able to observe them in a very satisfactory manner. He thus noticed that the black ants were engaged in repairing the nest which he had opened, digging fresh galleries, and conveying into them the stolen larvæ and pupæ; whereas the *Polyergi* took no further care about the latter, or the repairs of the nest, but retired to the deepest parts of their abode. From a long series of observations, it appeared certain that the mixed nests belong to the *Polyergi*, and that they are composed of three kinds of individuals of this species, and of workers of the *Formica fusca*, no males nor females of the latter being found in the nest; the larvæ and pupæ stolen are therefore those of neuters, which are no sooner arrived at the imago state than they share in the toils of their strange masters' nests, all of which are in fact borne by them, the *Polyergi* being unfitted for any other sort of labour but war. That this is the case, is moreover fully evident from the structure of their jaws, which are the chief organs employed in the construction of their abodes by the other ants, and which, in the *Polyergus*, instead of being large and strongly toothed, are slender, acute, and curved, and quite unfitted for carrying heavy and rough materials. That the situation of these slaves, toiling in a strange territory for strange masters, instead of labouring for their own community, cannot be regarded otherwise than as unnatural, will not be denied; but, when we reflect that these slaves have been born in this state, without knowing anything of a different state, that of freedom—that they toil not more laboriously for their masters than they would do for themselves, were they free, their instincts being essentially industrious, whether slaves or free—that they suffer no privations of food or repose—that they are even charged with the rearing of some of their own kind—and, moreover, that the state of society, dependent upon the structural peculiarities of the *Polyergus*, noticed above, requires their presence in the nest of the latter, we shall cease to think that the condition of these slaves is one of misery.

The genus *Ponera* seems intermediate between the preceding and following genera; unlike the former, the insects of which it is composed are furnished with a sting, and different from the following in having the abdominal peduncle composed of a single knot, the second joint being nearly as large as the following, from which it is, however, slightly separated at the hinder margin.

The type *Ponera contracta* (Latreille) is of a small

size ; it lives in small congregations under stones, the neuters being apparently destitute of eyes. "I have not," says Latreille, "been able distinctly to perceive the eyes, although employing a lens of half a line focus. I have seen a great number of specimens, both dead and alive, and with difficulty I have only once or twice fancied that I saw a darker coloured spot in the place of the eyes." He elsewhere adds, that "Nature having deprived this insect of one of its senses, has apportioned its operations to its powers. Hence it has not to endure the fatiguing toils of the other species, but contents itself in its little assembly, composed of a dozen individuals, with whatever it can find in the immediate vicinity of its nest." We have much pleasure in announcing the discovery of this interesting species in the neighbourhood of London.

The genus *Myrmica* is characterised by the possession of a sting; by the double knot at the base of the abdomen, by the six-jointed maxillary palpi and strong triangular mandibles. The type of the genus *Formica rubra* of Linnæus (misnamed in the *Régne Animal rufa*) is one of our common British ants. It is of a red colour, with the abdomen smooth and shining, the third segment being rather darker coloured ; the first knot of the abdominal peduncles is armed beneath with a spine. This species builds its nest in the ground under stones, moss, &c. The sting of the neuters is very acute.

Another small British species, *M. unifasciata*, so named from the black belt across the pale-coloured abdomen, has lately caused considerable annoyance to the inhabitants of the houses in various parts of Brighton, as well as in the metropolis, in which its swarms have increased to such an extent, that the inhabitants have been obliged, in some instances, to quit their residences, the ants devouring or attacking every article. Mr. Spence, by whom this subject was communicated to the Entomological Society, mentioned, that the only plan hitherto discovered for their destruction was to lay down pieces of raw meat, which they assailed in great numbers, and then to throw boiling water upon them.

The only other genus which we shall here notice is that of *Atta*, which we have already mentioned in its alphabetical place, and which we again introduce for the purpose of mentioning some circumstances connected with one of the species which are doubly interesting to the naturalist ; first, from their own nature ; and, secondly, from the confirmation which they afford of a long disputed question, and the necessity which they prove to exist of scrupulously attending to every circumstance of time and place in our endeavours to reconcile the statements of ancient naturalists with the results of our own inquiries. From the days of Solomon, who said, "Go to the ant, thou sluggard, consider his ways and be wise ; which having neither captain, overseer, or ruler, prepares her bread in the summer, and gathers her food in the harvest," it has been generally considered that the storing up of food by the ant was for the purpose of ensuring against want during the winter. When, however, observers of nature began to examine the habits of our northern European species, it was soon discovered that ants lay torpid during the winter, and consequently Solomon's statement was considered to be but a figurative expression. The fact was overlooked, that in climates similar to that in which Solomon's observation was made, the winter is not

sufficiently severe to render the insects torpid ; although, by some more philosophical observers, it was suggested (Kirby and Spence, II. 46) that, in warmer regions, during the rainy season, when they are *probably* confined to their nests, a store of provisions *may be* necessary for them. These ingenious suggestions have now been proved to be perfectly correct, by the publication of Lieutenant-Colonel Sykes' account of the habits of an East Indian species of the genus *Atta* (*A. providens*, Sykes, Trans. Ent. Soc.), which lays up a store of grass-seeds (*Panicum*) in the months of January and February sufficient to last until the middle of the year. Indeed, on the 13th October, after the closing thunder storms of the monsoon, he found this species in various places employed in drying the remains of their stores which had been wetted by the rain.

FORMICALEO. A name given by the old writers on natural history to the insect known by the systematic name of *Myrmeleon formicarium* of Linnæus, or the ant-lion. See MYRMELEONIDÆ.

FORSKOLEA (Linnæus). A genus of annual and perennial herbs, natives of Africa, belonging to *Urticææ*. The greenhouse species are easy of culture under the ordinary management.

FOSSIL REMAINS. This term is generally applied to designate the mineralised remains of organic substances, as indicating their having been dug from subterranean situations. Whenever organic remains, from their peculiar position in such situations, are preserved from decay for any considerable time, it is perfectly obvious that they must be liable to become impregnated with whatever matters may be in solution in the fluids with which they come into contact. Mineral substances may thus have been deposited in the original interstices and cavities of the organic body, without altering it in any other respect ; or in consequence of the partial removal of the original substance, may fill the space formerly occupied by it, and thus produce a cast of the same. In others the original matter appears to have undergone a decided chemical change, depending upon causes but little understood ; and one or other of these processes may have operated in producing all the varieties we find in the composition of the several earthy or metallic fossils.

The earthy substances which enter into the composition of fossils are chiefly of the argillaceous, siliceous, and calcareous kinds, in different states and proportions.

Thus we often find clay filling their cavities, and forming the beds in which they are found. They are also not unfrequent in bituminous strata, slate, and argillaceous ironstone, and a few have been met with in fullers' earth. Siliceous in different combinations enters into their composition. Quartz, chert, agate, chalcedony, jasper, flint, pitchstone, and semiopal, have all been found either forming their substance or constituting the matrix containing them. Limestone, marble, chalk, and oolite, are the most common instances of the calcareous kind. Fluates of lime have been found composing the matrix and very rarely the substance of fossils. Some nuclei have been discovered formed of hornblende, and both animal and vegetable substances have been detected in those rocks designated as basalt, wacke, and trap. Fossils are also found impregnated with metals of various kinds ; those which are the most common are iron and copper ; lead and zinc but rarely occur, and silver

still more rarely. They are generally found in the states of sulphurets or carbonates. The sulphurets and carbonates of iron are chiefly found entering into the composition of vegetable remains. Ligneous fossils of this kind exhibit the remarkable circumstance that although the texture of the wood appears unchanged, its substance has been so intersected by crystallisations that on decomposition it is resolved into an impalpable efflorescence. Those specimens of wood which have been mineralised by copper are frequently exceedingly beautiful, from the brilliant colours of the malachite which enters into their composition. Galena or sulphuret of lead has also been found in fossil wood, and blende or sulphuret of zinc, with quartz crystals investing fossil shells. Silver has been said to exist in a fossil having the appearance of ears of corn, found in the mines of Frankenberg in Hesse. Many fossils are also found either entirely unchanged, or very little altered, from their original state or condition. Shells, bones, teeth, and vegetables of various kinds, are to be met with in some alluvial deposits scarcely changed, and the remains of quadrupeds have been found well preserved in the ice of the polar circle. In limestone and other solid rocks shells are sometimes found in a nearly unaltered state. Ammonites unchanged and retaining all their pearly lustre, and resplendent tints of the most beautiful colours, are found in the splendid marble of Carinthia. Bones and shells occur in alluvial soils in a dry or fragile state, occasioned by the loss of their animal matter, this being the only change they have undergone. In fossil fishes we sometimes find not only the bones, but also the soft parts, and even the scales, more or less perfectly preserved, although a change of substance has of course taken place. Fossil vegetables occur either nearly unaltered or more or less bituminised or carbonised, in alluvial strata, in the brown coal formation, and also in some sandstones. Sometimes the organic body is merely coated or encrusted with the mineral matter, and but very slightly impregnated with it. This is most frequently the case with those found in the calc tuffa or calc sinter.

In giving a summary of fossil remains, we shall commence with the vegetable kingdom, and thence proceed with the lowest in the series of animated beings, endeavouring as briefly as possible to give an account of the most interesting objects in each division.

Vegetable remains occur in vast abundance and in great variety in different formations, particularly in the coal formation. Some of these are exceedingly well preserved, and thus afford every facility for the determination of their characters, whilst others are so much changed as to render it nearly impossible to make out the classes and orders to which they belong. In the plates of FOSSIL REMAINS in this work, representations of several impressions of fossil vegetables are given, principally ferns from the coal formation; they were copied from original subjects, and exemplify the general character of these fossils in a very striking manner. It is scarcely possible by description to succeed in an attempt to give an idea of the beauty and variety of the figures which are displayed on the surface of many of these fossils, many of which are supposed to owe their markings to the bark of different trees of antediluvian existence, and of which no trace is to be found at the present day. Some are ornamented by regularly-arranged straight ribs disposed longitudinally or transversely over their whole surface; others, by the alternate contact and

receding of gently waving lines forming areas, regularly but most singularly varying in their forms, and having, in their centres, tubercles and depressions, from which spines or bristles, in all probability, proceeded; others again exhibit surfaces apparently covered with scales, disposed in an imbricated manner, and frequently in quincunx order. Impressions of leaves occur in rocks of different descriptions, many of which resemble those of plants of the present day. In some instances beautiful specimens of aster-like flowers have been met with, and Schlotheim describes the impressions of a flower resembling a ranunculus from a metalliferous bed, near Frankenberg in Hesse; also impressions of an aquatic ranunculus or trolius in the limestone of Cœnigen. Innumerable seeds, seed-vesicles, &c., have been found in the blue clay of the Isle of Sheppy in the state of pyrites. Most of these belong to unknown plants, and the existing plants to which the others seem to approach are, generally speaking, those of warmer climates. They also occur in other formations, but usually in such a state as to render it almost impossible to ascertain the plant to which they belong.

The most simple of all the animal productions hitherto found in a fossil state are, the alcyonia and sponges. It has indeed been conjectured that the primitive seas may have swarmed with innumerable animals of the medusa tribe, whose bodies being entirely composed of a pulp or jelly, could not by any means have been preserved, although their decay may have had the effect of producing that peculiar foetid odour which is emitted by some limestones. The alcyonia are most commonly found impregnated with flint. Sponges are also abundant in the fossil state, and occur in great plenty in the flint of the chalk formation, and also in the chalk itself. Very many of those habitations of Polypi, commonly called corals, are found in a fossil state, and frequently in the most beautiful state of preservation. Several genera, as the *astræa*, *madrepora*, &c., are met with in the recent and fossil state, while others, as the *cyclolites*, *turbinolia*, *favosites*, &c., occur in the fossil state alone. In some formations they are met with in the greatest abundance, particularly in that part of the oolitic strata which, from this circumstance, is called the coral rag.

Of the next class, the radiata, very numerous and beautiful specimens occur. The crinoidea abound in many strata, and although found in vast abundance are scarcely to be met with in the recent state, a circumstance which shows the exceeding difference between the animal state of the former world and the present period. Much doubt remained as to the true place of these animals, until the excellent work of the late Mr. Miller removed all doubts as to their correct situation in the system. All those remains called entrochites and encrinites by former authors belong to this class. The animals of the asterias, or star-fish family, from the extreme delicacy and fragile nature of their structure, speedily decay, and hence are not common in the fossil state. Of the echini specimens occur exhibiting very great variety of form; and these, although not met with in the older secondary rocks, are extremely abundant in the newer, particularly in the chalk. Some of the species resemble those at present met with in our seas, but none of them, as far as can be ascertained, are absolutely identical with the recent ones. In the plates of FOSSIL REMAINS figures are given of two very beautiful

specimens. They are imbedded in flint, and are particularly remarkable as exhibiting many of the spines attached, which is a circumstance of very rare occurrence.

The fossil coverings or shells of the mollusca are amongst the most abundant of the organic remains, found in the strata of which this globe is composed. They are not only of great variety of forms, but also differ considerably in magnitude. Some, as the ammonite, occur of several feet in diameter, while others are so small as to require the microscope to develop them. They are divided into univalve, those composed of one piece or valve; bivalve, those having two valves; and multivalve, those with more valves than two.

The univalves are further subdivided into unilocular, those having but one chamber, of which the common limpet is an example, and those having many chambers, called from that circumstance multilocular, which division is well exemplified by the nautilus. Of the unilocular, a vast number of genera occur in the fossil state, and many of these include numerous species. The genera of multilocular shells are not so numerous, but their internal structure is of such interest as to deserve more particular notice. We may take the nautilus as our example, as being the best known of them; this has its shell formed into a number of chambers, each separated from the other by a division which is perforated with a small hole. The inhabitant is one of the sepia or cuttle-fish tribe, and resides in the upper or last formed chamber, which is consequently the largest. A tube, which is elastic, and to which the name of siphunculus has been given, proceeds from the animal, and, passing through the perforations in the divisions and the different chambers, terminates in the first or smallest one. It is conjectured, that a portion of the shell is contained within the body of the animal, independent of the connection it has with it by means of the siphunculus, which is membranous, and it appears probable is capable of rendering the animal buoyant or otherwise at pleasure, as the air-bladder does in fishes, by its being dilatable or compressible as occasion may require. The cells or chambers appear to contain nothing but air, as the animal must leave the last one formed as it produces a new one, having no other communication than that which is kept up by means of the siphunculus. Thus the animal, as it increases in size, occupies a new chamber, which is the last in order; and in like manner all those preceding have been left empty, so that the gravity of the shell cannot be much greater than that of the water of the sea, and hence the addition of a small quantity of air by means of the siphunculus will render it buoyant, and the expulsion of the air, and possibly the addition of a small quantity of water, will cause it to sink. Of these multilocular shells some few, as the nautilus, are found living at the present time, although but rarely met with, while the fossil species are extremely numerous. From this circumstance a question has arisen as to the cause of the great disproportion between the recent and fossil shells of this family; some maintain that the genera now found fossil are absolutely extinct, while others contend that they are deep water shells, and may still exist at the bottom of the sea, far beyond the reach of our observation. The structure of these shells, however, as before explained, being so admirably and beautifully adapted to render them buoyant or the contrary at the pleasure of the animal, must be

admitted as a proof that so far from being confined of necessity at the bottom of the sea, they must (supposing them still to exist) be able occasionally to rise up to and remain for a time at the surface, and consequently would in every probability be met with; but as hitherto not a single instance of any of these extinct genera having been thus seen is recorded, we may reasonably doubt of their existence at the present time.

Of this family of shells the ammonites form a remarkable tribe, not only on account of their beauty and variety, but also for their vast abundance and wide distribution in the mineral kingdom. By the vulgar they are supposed to be petrified serpents, and by others are considered as the types of the volutes of the Ionic order. In India they are regarded with great reverence by the Hindoos, as the emblem of one of their divinities. They occur in the gault, where their colours and pearly lustre are frequently most beautifully preserved. They are exceedingly abundant in the oolite and lias; upwards of 300 species have been described.

Our limits will not allow any further details respecting the remaining members of this family. Of these the BELEMNITE has already been described under that head, one of the species of which appears in the plate of FOSSIL REMAINS; another of these curious fossils, the hamite, is also figured. These as well as the nummulites, orthoceralites, &c., all agree in their general character and economy with the nautilus already particularly described.

Of the bivalve fossil shells the specimens are so numerous and varied in their forms, that it would be absolutely impossible to notice them in a single article. The reader must, therefore, be referred for an account of them either to their several descriptions in this work, under their respective names, or to the numerous treatises and works on fossil conchology. The multivalves are, comparatively speaking, of but rare occurrence.

From the perishable nature of insects, animals of this class rarely occur in a fossil state. They are, however, found in considerable abundance, and in excellent preservation, in a fresh water deposit at Aix in Provence. They are there so well preserved that their genera, and even their species, may be determined; sixty-two are enumerated by M. Marcel de Serres as belonging chiefly to the orders *Diptera*, *Hemiptera*, and *Coleoptera*. Mr. Curtis observes, on reviewing a collection from Aix, that they are all of European forms, and to be referred to existing genera. But one was found to be aquatic. "The antennæ, tarsi, and trophi, are generally very obscure or distorted; in a few the claws are visible, and the sculpture and even some degree of local colouring are preserved; the nerves of the wings in almost all the diptera are perfectly distinct, and even the pubescence on the head of one of them. Several of the beetles have the wings extended beyond the elytra, as if they had made an effort to escape by flying, or had fallen into the water while on the wing."

Many species of crabs occur in a fossil state. They are found in the Stonesfield strata and in the limestone at Pappenheim. They are also extremely abundant in the blue clay of the Isle of Sheppy, and many remains of crustaceous animals also occur in the chalk. But the most singular of these crustaceous remains is a fossil which was first observed about a century ago in the Dudley limestone. It attracted

great notice by its singular form and by its being totally different from all the petrifications which had been previously seen, as well as from every organised body known to exist upon the surface of the earth. There was, however, no hesitation in referring it to the animal kingdom, but a long time elapsed before it could be determined to what class it belonged. There was no doubt, however, of their constituting a perfectly natural family, and the name *Entomolithus* was the first proposed, which was subsequently changed into *trilobites*. The body of this singular fossil, as in the greater number of insects, and some crustacea, is divided transversely into three principal parts. But the most remarkable characteristic, and that which distinguishes it essentially from all known animals, is its longitudinal division into three parts or lobes by two deep furrows parallel to the axis of the body, which remarkable structure has excited the attention of all observers. At first the tails alone were noticed, and as they were considered as shells the name of *concha triloba* was given them, which designation was afterwards transferred to the whole animals by naming them *trilobites*, by which name they are still known. They appear to have been marine animals, their constant association in the same rocks with shells and other marine productions leaving no doubt upon this point. They must have had the power of multiplying prodigiously, certain formations being so crowded with them, as to give the appearance of their being entirely formed of their remains. They have been divided by Desmarest into five genera, each of which contains several species.

The fossil remains of fishes are found in considerable abundance. They occur under such different circumstances, in such various states, and in formations of such distant periods, as to lead the curious inquirer to expect much information of the highest interest from their examination.

In some specimens they are found nearly entire, the harder parts all in their natural situations with the scales and even the skin well preserved. In others all the other parts are removed except the skeleton, and this is more or less perfect, and frequently only the hardest parts remain, as the palates and teeth.

Fossil fishes are found in so great a variety of situations in various parts of Europe, and in formations so different, as to warrant the conjecture that they were among those animals which were of earliest creation, and whose existence has not been since interrupted. Among them are fish whose analogues live in the Indian ocean and in different seas of Africa and of North and South America. Among the fossil fish collected at Monté Bolca, there were four which were considered as corresponding to species now peculiar to the sea of Otaheité.

Vertebræ of various species of fish are extremely common, but the parts which occur most frequently in a fossil state are the teeth. They are divided into two groups, the *glossopetra* or more or less flattened teeth, which have belonged to fishes of the shark tribe, and the *bufonites*, or more or less rounded teeth, belonging to a certain species of *sparus*. The figure of a fossil fish given in the plate of fossil remains, is from a beautiful specimen found in the chalk.

Remains of the *testudo* or tortoise tribe have been detected in formations of different descriptions. In Great Britain they have been found in the lias near Bristol and in the oolite of Stonesfield, but the most

perfect specimens are from the clay of the Isle of Sheppy. Cuvier and others enumerate various species of land, freshwater and marine testudines found in various parts of Europe, but all of them apparently of extinct species.

Two species of crocodile have been found in the neighbourhood of Honfleur and Havre. In England they have been obtained from the Purbeck stone and from the combrash in Oxfordshire. Vertebræ have also been found in clay near Weymouth, and in the chalk in Sussex. But the most remarkable remains of amphibia are those of extinct genera of saurian animals, which differ from the crocodiles in many important particulars, and which astonish not only by their variety of form, but also by their prodigious length and dimensions. Of these the *lacerta gigantea* of Sömering, the *mososaurus* of Conybeare, is found in the soft limestone of Maestricht. The length of the skeleton is nearly twenty-four feet, the head being a sixth part of the whole length. The tail must have been exceedingly strong, and its width at the extremity must have rendered it a powerful oar, enabling the animal to resist the most agitated waters.

The *ichthyosaurus* appears to have been a marine oviparous animal, closely agreeing in the whole osteology of the head and sternum with the saurian tribe, except that the bones approximate to those of fishes in various particulars—whence the name indicative of its being the fish-like lizard is derived. The extremities terminate in four swimming paws or paddles, composed of a series of flat polygonal bones. Several species occur, found chiefly in the lias limestone of England.

The *plesiosaurus* is another of these singular fossil animals. It appears from its structure to have formed an intermediate link between the crocodile and the *ichthyosaurus*. But what chiefly distinguishes this animal is the prodigious length of its neck, by which it must have been enabled to seize its prey when at a considerable distance. This also occurs imbedded in the lias limestone in England. Magnificent plates of these last two genera have been published by Hawkins, in his work on the *ichthyosauri* and the *plesiosauri*, the originals of which are now deposited in the British Museum, forming without doubt, the most splendid collection of the fossil remains of these animals in existence. Various other genera have been noticed, of these the *iguanodon*, a reptile of enormous size, has been well illustrated by Mr. Mantell, by whom it was discovered in the strata of Tilgate forest in Sussex.

There is a remarkable genus of fossil flying animals about which considerable obscurity exists as to its proper place in the system. Blumenbach considered it as a bird, while Cuvier referred it to the amphibia. This is the *pterodactyle* or flying lizard. The skull of this singular creature must have been very large in proportion to the size of the skeleton, the jaws themselves being longer than the body, and furnished with sharp slightly incurvated teeth. The orbits of the eyes are exceedingly large, and hence it is probable that it was a nocturnal animal, like the bat, which it also at first sight very much resembles in the wings and other particulars.

The remains of birds are of rare occurrence in a fossil state, and the few specimens yet found afford results far less satisfactory than those obtained by the study of the fossil bones of other animals. Species

referred to the following genera are enumerated as found in the gypsum and limestone of the Paris formations, owl, buzzard, starling, ibis, quail, tern, curlew and pelican.

Among the most extraordinary fossil remains of the class mammalia, we must mention those of the extinct genera of the sloth kind. These, although not numerous, deserve notice on account of their magnitude and singular organisation. Two species have been described: the megatherium, properly so called, and the megalonyx. Of the first of these a complete skeleton was found in diluvial soil near Buenos Ayres, and sent to Madrid, where it was set up. It is fourteen feet long, and seven Spanish feet in height. The skeleton is so exceedingly rude and unshapely, that the clumsy skeletons of the elephant and hippopotamus when placed beside it would appear quite slender and light. Some of the bones of this extinct monster are in the museum of the College of Surgeons—casts of which have been taken and set up in the British Museum, where they excite great attention. It is one of the largest and most massive of the fossil quadrupeds hitherto discovered. Judging from its structure it must have been exceedingly slow and dragging in its motions; and, with the exception of its enormous claws, it appears to have been more defenceless than any of the other large animals. The form of its teeth prove it to have lived upon vegetables, and its huge claws were possibly used for digging up the roots upon which it is supposed to have fed. The megalonyx agrees in its general form and structure with the megatherium, and also resembles it in other respects. It has been found only in limestone caverns in Virginia.

The fossil remains of the elephant or mammoth, as it is commonly called, are found in vast abundance. Single bones, teeth, and even perfect skeletons occur, and one instance is on record of the whole animal being found in a perfect state imbedded in ice. The circumstances of this fact are so extraordinary as to merit a more detailed account. In the year 1799, a Tongoose fisherman observed on the borders of the Icy Sea near the mouth of the Neva, in the midst of fragments of ice, a shapeless mass, the nature of which he could not conjecture. Every succeeding year it became more developed, until at length it fell out of the ice upon a bank of sand. The fisherman possessed himself of the tusks, which he sold. Two years after one of the associates of the academy, of St. Petersburg was informed of this discovery and immediately repaired to the spot. He found the animal already greatly mutilated. The flesh had been partly cut away by the Yakoots for their dogs, and some of it had been devoured by wild beasts; still, however, the skeleton was entire, with the exception of one of the fore legs. The head was covered with a hard skin. One of the ears, in high preservation, was furnished with a tuft of hair, and the pupil of the eye was discernible. The skin was covered with black hair and an under coat of wool of a reddish yellow colour. The neck was furnished with a long mane. There were stiff black bristles from twelve to fifteen inches long, which belonged to the mane, tail, and ears. The remains were so heavy that ten persons had much difficulty in removing them. More than thirty pounds weight of hairs and bristles were carried away. The tusks were more than nine feet long. The remains of this singular and valuable relic of a former world were collected with

the utmost care, and are at present in the possession of the Emperor of Russia. From the wool which was found next the skin of this animal, Cuvier thinks it probable that the northern fossil elephants were inhabitants of those cold countries where their remains are found. The discovery of this body in so perfect a state also proves another important point, namely, that these animals must have been arrested by the ice immediately after their death, and consequently could not have floated there from distant southern regions. These remains are found in the greatest abundance in Siberia; and one of the islands to the north of that country abounds so much in these and other fossil bones, that the whole island is described as appearing to be entirely composed of them. This is doubtless an exaggeration, but it serves to show the wonderful abundance of these fossil remains.

The remarkable fossil genus mastodon is chiefly confined to North America. From a nearly complete skeleton discovered and set up by Mr. Wilson Neale, of Philadelphia, we learn that the species called the great mastodon of the Ohio was about as tall as an elephant, but with longer and thicker limbs. It was probably provided with a proboscis, or trunk, and had tusks similar to those of the elephant. In one of the depôts of these remains in Virginia, was found, inclosed with bones, a mass of roots, little branches, grass, and leaves, in a half bruised state, the whole enveloped in a kind of sac, which was considered to be the stomach of the animal. From this it appears to have lived on roots and the fleshy parts of plants, and hence this kind of food attracted it to soft marshy places, where its fossil remains are chiefly found. It is more common in North America than in any other part of the world, although its remains have also been found in Siberia. Another species, rather smaller, is described, which is found in Europe, and also in North America. Remains of several other species are also said to exist.

The fossil *Pachydermata* discovered by Cuvier in the plaster quarries of Paris, are also of the highest interest. In the *Anoplotheria* and *Palæotheria* we are presented with a view of an animal population of a former period of the earth's existence, which has been totally destroyed. Wherever these remains have been discovered, there are vast superincumbent beds of marine formation; proving the invasion and long continuance of the sea in the countries inhabited by those races.

The bones also which have been found in caverns in Germany, England, &c., although belonging to a far more recent period, deserve attention. In the cavern at Kirkdale, in Yorkshire, Dr. Buckland found bones of the hyena, tiger, bear, wolf, fox, weasel, elephant, horse, rhinoceros, hippopotamus, ox, deer, hare, rabbit, water rat, mouse, and others which were considered as belonging to various birds. In the German caverns at Gauleureuth, &c., we meet with two extinct species of bear, hyæna, fox, polecat, and wolf. These remains are embedded in a sedimentary deposit, which is usually covered with a stalagmitic crust. They occur in such abundance as in many places to be used for manuring the adjacent lands. The animals to which these bones belonged decidedly constituted the population which occupied our part of the world, at the era of the last great catastrophe which destroyed their races, and prepared the soil on which animals of our own era exist. Whatever resemblances certain of their species may present to those of our own times

it is no less remarkable than certain, that their general character was very different, and that most of their races have been entirely annihilated.

The species of deer known by the name of the Irish elk, affords one instance, at least, of an animal which has apparently become extinct since the existence of man upon the earth. It occurs in a fossil state in Ireland, the Isle of Man, England, Germany, and France. The most perfect specimen of the skeleton of this species hitherto met with, is that which was found in the Isle of Man, and is now preserved in the Museum of the University of Edinburgh. It is six feet high, nine feet long, and in height, to the tip of the right horn, nine feet seven and a half inches. It was embedded in a loose shell marl, in which were numerous embedded roots and branches; over the marl was a bed of sand, above this a bed of peat, and over the peat the common soil of the country.

Hitherto no remains of apes, baboons, monkeys, or other tribes of the order *Quadrumana*, have been met with, nor any trace of their existence, unless we consider that those extraordinary casts in sandstone of the impressions of the feet of some unknown animal, which have been found in Germany, are to be referred to animals of this kind. A slab of this stone, with these impressions, is in the British Museum, and the cast taken from it exhibits the appearance of the impression of a large thumb, with indistinct traces of parts of the other extremities of some animal, occurring at regular distances, forming an object well worth the attention of the curious visiter.

A fact must now be noticed connected with fossil osteology, of the most remarkable and striking kind. We find the remains of different genera of quadrupeds, birds, reptiles, fishes, insects, mollusea, and vegetables, in the fossil state; but hitherto no human remains have been found, nor any traces of the works of man in those particular formations in which these different organic fossils have been discovered; that is to say, no human bones have been found in the regular strata of the surface of the globe. In alluvial beds, peat bogs, and ancient burial grounds, they are dug up as abundantly as the bones of any other living species; but not a fragment of human bone has been found in such situations as to lead us to suppose that man was contemporary with the more ancient races, with the *Palæotheria*, *Anoplotheria*, or even with the elephants, megatheria, and rhinoceroses of a comparatively recent era. Nothing has been found to indicate the existence of the human race at a period antecedent to the last general catastrophe of the globe, at least, in those parts where the study of organic remains has been followed up by a careful examination of the strata. It is true that several years ago human skeletons were discovered in a compact calcareous rock in the island of Guadaloupe. A mass of this rock, containing a pretty well preserved human skeleton, but without the head, has been deposited in the British museum. The rock, on examination, proved to be a mere alluvial mass, formed of pieces of coral, that appears to have been thrown up on shore by the sea, and afterwards cemented together by water impregnated with calcareous matter. This, therefore, can be no proof of the ancient existence of man, and the writer of this article considers himself justified in concluding that the human race was not coeval with the fossil genera and species.

The study of fossil remains is one of the utmost importance in geology. By it alone we are enabled

to form precise notions concerning the history of the earth. Had these been totally neglected, we could never have imagined that successive eras, and a series of different operations had taken place in the formation of the globe. By them alone we are assured that the covering of this planet has not always been the same, as it is obvious that before they were buried in its depths they must have existed at the surface. By them we learn that certain strata have been tranquilly deposited in a fluid mass; that the variations in the strata have corresponded with those of the fluid; that the translation of this fluid occasioned their denudation, and that this denudation has taken place more than once. Nothing of this could have been ascertained with any degree of certainty, but for the study of fossil organic remains.

FOSSORES (Latreille). An extensive sub-section of hymenopterous insects belonging to the division *Aculeata*, or those furnished with a sting in the females. There are only two kinds of individuals in each species, male and female, both of which are winged. They are solitary in their habits, each species taking upon itself the care of forming and provisioning, or, at least, seeking a nest for its progeny. The legs are formed only for walking or for burrowing; the wings are never folded longitudinally as in the wasps. In our article **ENTOMOLOGY** we have figured the fore leg of one of the burrowing species of this sub-division, by means of which the females are enabled to excavate cells in the ground or in wood, in which they then bury a certain quantity of other insects, spiders, or larvæ, which they have half stung to death, which serve for the food of the larvæ hatched from the eggs deposited in the cells at the same time. These larvæ are footless grubs of a fleshy consistence, resembling a short worm or maggot: when arrived at the full size they spin a silken cocoon, in which they are transformed to pupæ: the perfect insect is generally extremely active, feeding upon the nectar of flowers. Some of the exotic species are of very large size, and their stings are very painful. Some of the species belonging to the sub-division are not provided with organs for burrowing, and accordingly are compelled, like the parasite bees, to deposit their eggs in the already provisioned nests of other species. M. le Comte de Saint Fargeau was the first author who noticed this parasitic connexion between the species; but by raising a theory upon too limited observations, he considered that all the species whose legs were destitute of the brush-like spines, were necessarily parasitic. This theory was successfully attacked by Mr. Shuckard, in the first number of the *Transactions of the Entomological Society*, by whom it was shown that amongst the species destitute of spines, many were wood-borers; hence he proposed the theory that those species, and those only, which burrow in sand are furnished with spines; subsequent observations have, however, convinced the writer of this article that Mr. Shuckard has likewise founded his theory upon too limited observation, several spineless species having been detected in burrowing in sand.

This sub-section comprises the families *Scoliidae*, *Sapygidae*, *Sphegidae*, *Bembicidae*, *Larridae*, *Nyssonidae*, and *Crabronidae* (including the *Cercerides*). To these groups the *Mutillidae* must evidently be added, which differ only in the apterous condition of the females.

FOTHERGILLIA (Linnæus). A genus of North

American deciduous shrubs long introduced into our gardens. Class and order *Polyandria Digynia*, and natural order *Hamamelidææ*. Generic character: calyx bell-shaped, truncated, whole, persisting; corolla none; stamens filaments thickened above; anthers erect, quadrangular, and two-celled; styles two, awl-like; stigma simple; capsule hard, two-celled, cells two-valved; seeds single and bony. These ornamental plants thrive in the borders of moor earth, and are increased by layers.

FOX (*Vulpes*). A genus of mammalia belonging to the sub-order or section *Carnivora* of Cuvier's great order *Carnassier* in the Animal Kingdom. They are usually considered as only a variety of the extensive genus *Canis* (dog), which, in the systems, comprises the dogs properly so called, and along with them the wolves, and the jackals, all considered as dogs; and also the foxes, and the fenne, together with the wild dog of the Cape, which last has in fact many of the characters of the hyænas, though its teeth are said to be differently constructed.

Generally speaking, foxes do not differ much in their organisation from dogs. Like these, they have six incisive teeth in each jaw; one canine on each side of both, six cheek teeth above and seven below in each side; the first four in the lower jaw and first three in the upper small, but with trenchant edges. The great carnivorous bruising teeth, situated behind the trenchant ones, with two points and a tubercle on the inside in the upper jaw; but the lower jaw with the last lobe of each entirely tubercular. The last two teeth in both sides of each jaw wholly tubercular on their upper surfaces, and thus indicating that the animals are not in the highest degree carnivorous, but can subsist upon other aliment besides flesh. The foxes have also, like the dogs, five toes on the fore feet, and four on the hind; and the females have mammæ both on the belly and in the groin.

The distinguishing characters of the foxes from the dogs, and from all the other sections of the genus, are: the pupils of the eyes closing on a vertical line, though opening nearly to a circle; the tail longer and much more bushy or thickly covered with fur; the skin altogether covered with finer and closer fur, in some of the varieties of great beauty and esteemed at a high price; and the muzzle more elongated and pointed at least than any of the others in a wild state. The incisive teeth in the upper jaw are also more furrowed; they all have a fœtid and offensive, though peculiar, smell, and they burrow more habitually in the earth. Perhaps we may add that their canine teeth are more keenly pointed, that those in the lower jaw are larger in proportion to those in the upper, that they are more advanced in the jaw, and stand more apart from each other at the points. From this structure of the most efficient part of the mouth in killing their prey, it follows almost by necessary consequence that the foxes inflict a mortal wound by a single bite, and do not mangle their prey like some of the others. The smallness of the muzzle, the nearness of the deadly weapons to its point, the length of the jaws, and the consequent velocity with which the large and keenly-pointed canines in the lower jaw can be moved, enable them to reach the vulnerable part of their prey more readily, and inflict their wound more speedily and certainly.

It is in their manners, however, that the foxes are most distinguished from all other canine animals. Many of the others are nocturnal as well as the foxes,

but none of them have that form of nocturnal eye which enables the owner to see prey when above it; and thus the eyes alone of the foxes would point out their great propensity to robbing a hen roost, or seizing pheasants and other gallinaceous birds on their perches, when perching near the ground. Foxes are also more decidedly dwellers in holes of their own excavation, or "earths," as they are technically called, than any others of the family, though the whole do reside in dens and hiding places, except when they are abroad hunting. The structure and formation of the eye, which we have noticed, and also this mode of lodging, indicate, if not a cowardly, at least a cautious animal, which will not attack any creature that may stand on the defensive. The softness of the fur too and the bushiness of the tail all indicate a capacity of proceeding silently through brakes and bushes, so as to come upon the prey unawares, and kill it by the rapid snapping bite, before it is aroused either for escape or for defence. Another character which, among the whole race, is peculiar to the foxes, is that of being quite solitary in their operations, and never joining for any common purpose where numbers can make up for the want of individual strength. We know little of dogs in a state of nature, as may be seen by referring to the article Dog in this Cyclopædia; but it is probable that in this state they invariably help one another in cases of need. This is the known practice both of the wolf and the jackal, the first of which sometimes make attacks in very formidable troops, and the latter, though not so bold and ferocious, are generally found yelping and prowling for their food in company with each other. But it does not appear that the barking of foxes is ever to be viewed in the light of an assembling call. In the season, it may be calling and answering between mate and mate, and at other times it may be done with the intention of alarming the prey, and causing it to make so much noise that the acute ear of the fox may hear it in the dark and steal upon it. There seems to be in this habit enough to entitle foxes to separate consideration as a subgenus, if not a separate genus from all the rest; because it indicates that foxes act a part in the economy of nature which could not be exactly supplied by any or even by all the rest of the race, if the foxes should become extinct.

This, if we could arrive at it with knowledge sufficiently minute and accurate, is perhaps the real ground upon which the distinctions of genera should be placed; because the part which it plays in nature is the ground upon which to estimate the real value of any animal; and if this could be made the foundation of our systems of classing, then those systems would have some better claims to the merit of being natural than they have even when they are arranged most strictly according to the anatomical structure, both external and internal. That there is much in the organisation we do not deny; but still organisation is not life, and therefore when we have studied that even to the utmost, there is still something in the animal which is not exhausted, but which claims our inquiry, and is in all probability more fitted for rewarding it than even the other.

Foxes are found in many parts of the world; but they are most abundant in temperate and cold climates, especially the latter; so that there are probably more foxes in the cold parts of the northern latitudes of both continents than there are in all the rest of the world taken together. The character of their cover-

ing indeed points them out as animals fitted to endure the rigours of climate; and their habits conspire with their covering in enabling them to do this. They are always in cover of some kind, unless when they can with safety to themselves, and also with "chance" of prey, prowl about so as to keep themselves in heat. In the north they are indeed found in great numbers, and are obliged to be abroad at times when the weather is severe; but in these places and at these seasons, their coats are proof against all weathers, and while the temperature remains so low that there is no chance of thawing, a burrow in the snow is as snug and warm as a burrow in the earth.

Foxes are not migrant in any country, and they do not shift their quarters much with the seasons, even in those places where there is a shifting of this kind on the part of other animals. When the winter is severe the wolves descend in numbers from the mountain forests, and often commit fearful devastation; but foxes do not even invade hen-roosts more in the winter than in the warm season, if they even do it as much.

This constant remaining in the same locality through the vicissitudes of the year, and being tempered in their covering to the change, is in all probability one of the reasons why there is so much difference of opinion about the varieties or species of them. Amid all the apparent variety, they are, however, true to the habit; and in this respect there is perhaps less variation among foxes than among any other animals which are equally numerous and widely spread.

With all their powers of change, they appear, however, to be hardy and healthy animals, and we believe the body of a fox that has died a natural death is a very rare occurrence. No doubt there is, on the part of mankind, a strong propensity to thin their numbers, for mere sport, for the sake of the skin, and from the havoc which they commit on the weaker sorts of domestic animals, birds especially, and game. There is one point connected with them which is worthy of some attention: they do not fade before the progress of cultivation, as many predatory animals fade; and, therefore, it would be worth while to ascertain whether, in spite of his mischief in the poultry yard, reynard be not a *useful* animal.

Common as foxes are, and much as they have occupied the attention and drawn down upon themselves the vengeance of mankind, there are very considerable doubts respecting some of the species. This is especially the case with those foxes which inhabit the polar climates of the northern hemisphere; and indeed it is there that we might be prepared to expect the greatest confusion on the part of those who establish a different species upon mere diversity in size or colour. We shall notice what we consider as imaginary species in our list of those to which they appear really to belong; and thus restricted, the list will not exceed six or seven species. We begin with the common fox, so well known in our own country.

THE COMMON FOX (*Vulpes vulgaris*). The medium height of the common fox is about one foot. From muzzle to the other extremity of the body it averages about two feet and a half. A fawn colour intermixed with black and white constitutes its characteristic hue. On the head, along the spinal column, the flanks, the posterior part of the limbs, and the sides of the tail, the fawn predominates. Greyish fawn sprinkled with white prevails on the thighs and shoulders. The under part of the neck and breast anteriorly, a kind of half collar

at the bottom of the neck, and a narrow spot commencing at the internal angle of the eye, and descending towards the throat, are black. It is quite unnecessary, however, to dilate on the colours of an animal so well known. The coat is thick, especially on the back and tail. In winter the woolly are more abundant than the silky, and the fur is more valuable at that season. The silky hairs predominate in summer, and their number is not so great. The physiognomy of the common fox, its slender muzzle, large head, and shortness of limbs in comparison of the body, are very generally known. The organisation of the fox and dog, with one exception, are precisely similar. This exception is the eye, which in the fox resembles that of our domestic cat, and not that of the dog. In a strong light the pupil contracts, and appears only a narrow and longitudinal section. It opens and assumes a circular form only during twilight or night. Consequently this animal, like the cat, avoids the light, and prefers darkness and obscurity.

We need scarcely mention that the fox has been proverbially celebrated for his cunning, and although this feature in his character has given rise to much exaggeration and fable, his proceedings are more under the guidance of subtlety and craft than of courage, or the spirit of enterprise. He chooses his habitation in brakes, woods, or coppices, preparing his bed under hard ground, the roots of trees, or similar situations, where he can contrive proper outlets to escape from danger. He does not always take the trouble of making a hole for himself, but often procures accommodation by dispossessing the badger. His lodge is seldom remote from the habitations of man, and is frequently found in the neighbourhood of some farm-yard or village. He listens to the crowing of the cocks, and the cries of the poultry, scents them at a distance, selects his time with judgment, conceals his road as well as his purpose, slips forward with caution, sometimes even trailing his body, and very seldom makes a fruitless expedition. If he can either leap over the wall, or creep in underneath, he ravages the court-yard, puts all to death, and retires softly with his prey, which he conceals under herbage, or carries off to his kennel. In a short time he returns for more, which he bears away, or conceals in the same manner, but in a different place. In this way he proceeds systematically, till the progress of the sun, or some movement perceived in the house, warns him that it is time to suspend his operations, and to retire to his den. The nets and bird-lime of the fowler he visits early in the morning, removing, in succession, the birds that happen to be entangled, hiding them in different places, where he perfectly well knows where to find them, even after some days have elapsed. The young hares are hunted by him in the plains, he seizes old ones in their forms; digs out rabbits from their warren; detects the nests of partridges and quails, seizes the mother birds whilst sitting on their eggs, and destroys a vast quantity of game. In procuring young rabbits from their burrows, he follows their scent above ground, till he comes to the end where they lie, and then, scratching up the earth, descends on them and despatches them. Should there be no other victims, he makes war on rats, field-mice, serpents, lizards, toads, and moles, of which he consumes great numbers, playing with them, like the cat, before devouring them. He will also eat roots and insects when urged by hunger, and will seize on crabs, shrimps, and shell-fish, when near

the sea-coast. Grapes, and other sweet fruits, he manifests a predilection for, and will boldly attack wild bees to get at their stores. When assailed by the hosts which fasten on him with their stings, he retires, but only for a few minutes, rids himself of his opponents by rolling on the ground, and crushing all that stick to him, and then returns to the charge, and devours both honey and wax.

The active foresight of the fox will often prompt him, even when sated with food, to prolong his researches, less with the intention of discovering fresh booty than of exploring the details of his future resources. Thus he frequently returns to the various holes which he has cleared, surveys them with much precaution, enters into them, and sily examines their different issues. He approaches objects that are new to him with cautious slowness, and which, on account of their novelty, excite his suspicion and distrust. This timid prudence, however, completely disappears in the female fox when she has young ones to nurse and defend. The maternal instinct which, in all species, the human not excepted, is probably the strongest of all feelings, effaces the specific character of the animal. There is no sentiment so completely disinterested as this, none in which the sacrifice of self is so instantaneous and so complete. The mother will not hesitate a moment to endure the utmost privation, to brave the most appalling danger, nay, to encounter the certainty of death, for the preservation of her infant offspring. She that, but a little before, was all gentleness, shrinking timidity, and fastidious delicacy, who could not bear the winds of Heaven to visit her face too roughly, on the sudden becomes bold, fierce, and resolute, unshaken by all that is trying, and unrevolted by all that is disgusting. The female fox watches incessantly over her young, provides for all their wants with unwearied assiduity, and exhibits an audacity very foreign to her general disposition against their most formidable adversaries.

We should be inclined to trace this maternal instinct; if we might presume to conjecture at the proximate cause of it, like many other powerful sentiments in animal nature, to some sensation of physical pleasure by which its exercise is accompanied. Those feelings, even in man, which assume for a time the completest domination over his constitution, have sensual pleasure as their origin and object, however remote their apparent distance from such a source may be, however they may be glossed over by high-sounding names, or to whatever degree of refinement they may be spun by those mighty casuists, vanity and self-love. Most of our feelings and ideas, however refined and abstracted, are resolvable, in their last analysis, into physical sensation, and the closer their connexion is with this primal source, the more impetuous and commanding is their influence. If this be the case with man, it is much more strikingly so with the brute creation.

Foxes are generally in heat about the month of February. They are then heard to utter very sharp yelpings; which commence like the barking of a dog, and end in a sound resembling the cry of the peacock. Gestation continues for from sixty to sixty-five days. When the female is ready for parturition, she prepares a bed for her young with leaves and hay. She produces only once a year, and has from three to eight young at a time. The cubs are born like dogs, covered with hair, and having the

eyes shut, and continue growing for about eighteen months. If the dam perceive the place of their retreat to be discovered, she carries off her cubs, one by one, to a more secure habitation. At about three or four months old, the young foxes quit their burrow. They abandon their parents with all convenient speed, and at two years of age their growth is completed.

In the days of his inexperience, a favourite lure will ensnare him, but, when apprised of its nature, the same expedient becomes unavailing. He seems to smell the very iron of the trap, and carefully shuns it. If he perceives that the means of ambush are multiplying around him, he quits his place of residence, and retires into some more secure quarters. Man, with all his reasoning and machines, requires himself much experience not to be over-reached by the prudence and stratagems of this wily quadruped. If all the issues of the kennel are beset with snares, the occupant scents and recognises them, and, rather than fall into them, exposes himself to the most cruel and protracted privation of food. In confinement, this state of alarm is neither mechanical nor passive, for he leaves nothing untried to escape from danger; and, while a claw remains, he works at a new path, by which he often eludes the menaced ruin. In the fox, in short, as in the wolf, we may remark an aptitude to acquire habits, and to be regulated by his reflections on existing circumstances. He is comparatively ignorant and careless of his conduct when no war is waged against him; but, when the apprehension of pain or death, exhibited under various forms, has produced multiplied sensations, which become fixed in his memory, and give rise to comparisons, judgments, and inductions, he acquires skill, penetration, and cunning. If the imprudence and thoughtlessness of youth frequently make him deviate from the right path, the experience of age corrects his wanderings, and teaches him to discriminate true from false appearances. Foxes sleep much during the day, and lie, like the dog, in a round form. In very warm and clear weather, he may sometimes be seen basking in the sun, or amusing himself with his fine bushy tail. Magpies, crows, and other birds, which justly consider him as their common enemy, will often give notice of his presence by the most clamorous notes, and follow him a long way repeating their outcries.

The fox's skin is furnished with a soft and warm fur, which, in many parts of Europe, is used for muffs, boas, and lining of clothes. Vast numbers of foxes, on this account, are taken in the Valais, and the Alpine districts of Switzerland, insomuch, that a Lausanne furrier is sometimes in possession of two or three thousand skins, all procured in the course of a single winter. Vast numbers of them are likewise imported from Newfoundland and Hudson's Bay. Notwithstanding the rankness of the fox's flesh, the natives of the latter country eat it; and even the inhabitants of some parts of the continent of Europe have recourse to it, during the vintage, when the animals are fattened with the grapes.

Fox-hunting, it is almost superfluous to mention, is a very favourite diversion with many of the nobility and gentry of this country, and that it is more zealously and successfully prosecuted in England than in any other country in the world. When the fox finds himself pursued, he generally makes towards his hole, and, penetrating to the bottom, lies till a terrier

is sent in to him. Should his den be under a rock or the roots of trees, the terrier is no match for him, and it would be no very easy matter for his enemies to dig him out. His stratagems and shiftings are as surprising as they are various when the retreat to his kennel is cut off, for he betakes himself to the woods and coppices of the country, and prefers the paths that are most embarrassed with thorns and briars. When before the hounds, he runs in a direct line, and, if hard pushed, resorts to the low wet grounds, as if conscious that, in such situations, the scent is with more difficulty traced. He becomes obstinately desperate when overtaken, and will turn on his adversary, and defend himself to the last gasp. The severest blows will not make him loose his hold; and he fights in silence until he is torn and mangled to death. Horses and dogs both, particularly the former, have very frequently fallen victims to the ardour of the chase, which sometimes has continued for eight or ten hours, almost at full speed, without the smallest interruption, and for a distance of forty or fifty miles.

The fox can be tamed, if taken when quite young, but seldom entirely loses his savage nature. Instances have, however, occurred of a domesticated fox showing nearly as much attachment to his master as a dog. The fox's olfactory nerves, as it is well known, are very acute. Like the dog and the wolf, he runs his game down by the scent. On the approach of a storm, or preparatory to a change of weather, he howls dismally. In the summer season the male, and more particularly the female, is very subject to cutaneous disorders; and it is asserted that, if a horse lie down on the spot previously occupied by a fox, he will likewise be infected.

Many anecdotes have been mentioned and recorded of the craft of the fox, and some of them place the sagacity of irrational animals in a very striking light, and perhaps none more so than those in which the crafty animal attempts

“To run away from death by dying,”

or rather, by counterfeiting death. One morning early, a man in the north was going to his work through furze bushes on a common, and came upon a fox stretched out at length under the side of one of the bushes. The fox was drawn out by the tail, swung right and left, and then laid on the ground, but not a symptom of motion or life did he show. The man, never doubting that reynard had gone the way of all foxes, and nothing loth to add a fox-skin cap to the list of his personal garniture, and the brush to the tale of peacocks' feathers, and other ornamental trophies, over the little looking-glass that stood inclined from the wall of his cottage, took the animal by the tail, and swung it over the one shoulder, at the same time placing his mattock on the other, to keep up the balance; and, having done so, onward he trudged to mend the high-road, for the accommodation of those who got foxes and their brushes in another way, which was his ordinary vocation. The two shoulderings were not exactly paired, and so the mattock began to assail the ribs of the fox in no very gracious manner. The animal had counterfeited death to admiration, and he did not mind being carried in the manner of a dead fox (it is remarkable that dead animals are usually carried with the head downward); but, dead as he seemed, he had no inclination to undergo that species of dissection which the point of the mattock was ever and anon giving his ribs. So

at last he gave that decisive snap, which we have described as the characteristic bite of foxes, on that portion of the labourer's rear which is supposed to be more sensitive to all manner of inflictions than any other region of the human body. The man felt that something was the matter, but knew not very well what; so, throwing fox and mattock from him, he turned round to face the foe, whoever he might be, and, in turning, he espied his dead fox at the distance of full fifty yards, making for the brake with all imaginable speed. The man was much annoyed at his adventure, and wished to conceal it; only, he told it to his fellow-labourer as a great secret, and thus, as is generally the case with secrets confided in this way, rendered it better worth telling than it otherwise would have been.

We shall mention one other anecdote, which came within the personal knowledge of the writer of this article, because it throws some light on the mode of action of the fox, as well as confirms the truth of his counterfeiting death in all cases where there is a likelihood that it may ensue. The parsonage of Kilmorae, in Inverness-shire, is situated in a highly romantic spot. It is near the brow of one of the precipices which form a gorge through which the river Beauly has, in the lapse of ages, cut a deep channel through a great length of rock, thus emptying a lake which must at one time have occupied that singularly beautiful dell known by the name of the Dream of Kilmorac. The northern bank of this singular valley, or rather ravine, for it is something intermediate between the two, is richly wooded, and much of the sloping ground is a natural strawberry bed. It swarms with all those inhabitants, whether of the air or of the earth, which are found in warm and wooded spots of the Highlands. To render the collection complete, there are eagles in some of the towering rocks, near the lower part, and no want of goshawks anywhere; the hill beyond, too, is well stored with grouse, and as it is near the cultivated grounds, there are common hares as well as Alpine ones. Of course this is a very favourite retreat for foxes; and though the wild cats are said to keep them at bay, when they attempt to assail the preserve, they kennel in the margins, and infest the country around. The then clergyman of Kilmorac was a man of great taste, very fond of society, and very hospitable, and he accordingly endeavoured to provide for his numerous guests all the good things which his glebe land, on field or on hill, could afford.

A well-stocked poultry-yard is an essential requisite in such cases; but here foxes were so numerous, and their covers so near, that a poultry-yard was out of the question; and it was sometimes necessary to employ boys to “Hoo! hoo!” the fox even after the parson's pullets were turned out to range the fields. A poultry-house was thus requisite, and the Reverend Doctor prided himself not a little in having constructed one which was completely fox-proof; and for a good many years it had been impregnable to reynard, so that the Doctor's pullets and their eggs were known far and wide for their excellence, their abundance, and the frankness with which they were given to every one who courted the very pleasant society of their owner. A friend of ours had spent a night in this romantic and hospitable abode; and, while fresh salmon from the Beauly, dressed in very delicious steaks, formed one article for the breakfast-table, new-laid eggs, from the strong-hold of the hens, were of course to form another. Christian, the purveyor in

these cases, took the key, and marched off, basket in hand, to bring the supply ; but, when she opened the door, a scene of the most direful havoc presented itself. Every perch and nest-hole was bedabbled with blood, dead hens lay in dozens on the floor, and in the middle was a full-sized fox, stretched out at full length, and—apparently a sharer in the common mortality. The maid never doubted the death of the fox, but attributed it to a different cause, namely, that he had so gorged himself on the poultry, as that he had burst. Here were three causes to rouse the mingled wrath and content of Christian. The fox had, by some means or other, shown that the place was not impregnable ; there had been terrible havoc among the hens ; and the fox had been gluttonous even to the death. She pronounced his funeral oration in certain most expressive Gaelic phrases, which we shall not quote, and will not translate ; and then, without further ceremony, gave him a resting place, which she said was worse than a dog's burial. She took him up by the tail, and swung him with all her might into the receptacle in which were accumulated the requisites for garden compost. The fox fell softly, and rose again speedily, and, like Curll the bookseller in the *Dunciad* ; he “scoured and stunk along,” until he gained the cover of the woods, leaving Christian in utter consternation, and the minister minus both his pullets and the glory of his impregnable hen-house.



Common Fox.

The entrance to this place was by a stone some feet from the ground, with a little hole over it, and by this the fox must have gained admission, and so, gaining admission, he had killed every fowl that he could reach ; and he must have killed them so silently and so suddenly, as that no noise or complaint on the part of any one had in the least alarmed the others. This is, we believe, the most striking peculiarity of the fox on his predatory excursions, and the above anecdote shows it in a very striking light, for there were perches so elevated that no fox could reach them ; and as the pullets were in the habit of taking to them in other cases of alarm, of course they would have done so upon this invasion of the fox, if his deeds of slaughter had been attended with any noise. We have mentioned those anecdotes because they are characteristic, and we know them to be true.

The BLUE FOX or ISATIS (*V. lagopus*). This species occurs only in the arctic regions, a few degrees within and without the polar circle, particularly in Kamtschatka, and all the country bordering on the northern ocean. It is inferior in size to the preceding, and is sometimes to be met with entirely white,

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though it is generally of a bluish grey colour. It is so very hardy as to prowl about for prey during the utmost rigour of the hyperborean winter. It subsists on young wild-geese, and all kinds of water fowl and their eggs, on hares, the smaller quadrupeds, &c., and frequently from necessity, on wild berries, shell-fish, or other substances rejected by the sea. They, in some regions, burrow in the earth, and form holes many feet in length, strewing the bottom with moss ; but where the ground is seldom quite free from frost, as in Spitzbergen and Greenland, they live in the clefts of rocks, two or three inhabiting the same hole. They are in the habit of crossing from island to island, in quest of prey, being very excellent swimmers. They are caught in pitfalls, springes, or traps, baited with eapalin or a bit of flesh, for the sake of their skins, which form a light and warm, but not a durable fur. The most interesting account, by far, which we know of the manners of this species, is that which Steller relates ; but we shall only give a part of the passage to which we allude. “When we made a halt to rest by the way,” says Steller, “they gathered around us, and played us a thousand tricks in our view ; and when we sat still, they approached us so closely, that they gnawed our shoe-strings. If we lay down as if intending to sleep, they came and smelt at our noses, to ascertain whether we were dead or alive. On our first arrival, they bit off the noses, fingers, and toes of our dead, when we were preparing the grave ; and thronged in such a manner about the infirm and sick, that it was with difficulty we could keep them off.

“Every morning we saw these audacious animals patrolling among the sea-lions and polar bears, lying on the strand, smelling at such as were asleep. If death happened to be the case, they proceeded to dissect him immediately, and soon afterwards all were at work in dragging the parts away. As the sea-lions, in their sleep, sometimes overlay their young, the foxes every morning examined the whole herd of them, one by one, as if conscious of this circumstance, and immediately dragged away the dead cubs from their dams.

“As they would not suffer us to be at rest by night or day, we became exasperated against them, young and old, and harassed them by every means we could devise. When we awoke in the morning, we always saw two or three that had been knocked on the head the preceding night ; and I can safely affirm, that, during our stay on the island, I killed above two hundred of these animals with my own hands. On the third day after my arrival, I knocked down with a club, within the space of three hours, upwards of seventy of them, and made a covering to my tent of their skins. They were so unsuspicious, that with one hand one could hold to them a piece of flesh, and knock them down with a stick or axe in the other.

“From all the circumstances that occurred during our stay, it was evident that these animals could never before have been acquainted with mankind, and that the dread of man is not innate in brutes, but must be grounded on long experience.

“Like the common foxes, they were the most sleek and full of hair in the months of October and November ; in January and February it was over thick ; in April and May they began to shed their coat ; in the two following months they had only wool on them, and appeared as if they went in waistcoats. In June they dropped their cubs, nine or ten at a brood, in holes or clefts of the rocks. They are so fond of their young, that to scare us away from them, they barked

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and yelled like dogs, by which they betrayed their covert. But no sooner did they perceive that their retreat was discovered, than (unless they were prevented) they dragged the young away in their mouths, and endeavoured to conceal them in some more secret place. On one of us killing the young, the dam would follow us with dreadful howlings, by night and day, for a hundred versts or more, and would not even then cease till she had done her enemy some material injury, or was herself killed by him."

This species is very ragged and rough looking, during the process of changing its colour, and until near its conclusion. The change is no sooner completed, than the colour becomes uniform. It is of a pure white during winter. A dorsal line of a darker colour is observable in summer, with transverse stripes upon the shoulders, from which peculiarities it has been occasionally confounded with the cross fox. The paws are entirely covered with long hairs, and those on the other parts of the body are about two inches and a half in length.

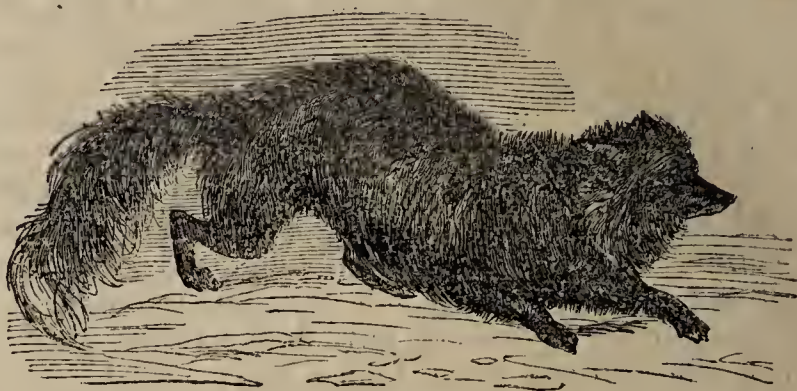
Mr. Lloyd, in his "Field Sports of the North of Europe," describes the arctic fox as differing very materially from those of the common species. "He has," says Mr. Lloyd, "neither the cunning nor speed, and he is besides less cautious and timid." And according to the concurrent testimony of all travellers to the arctic regions, he is so little afraid of man that he may be readily knocked on the head with a bludgeon. "It has happened that this species has been killed in the most southern parts of Sweden; but it has been noticed that, instead of flying from his assailants, as is the case with the common fox, he has stood contemplating his approach until the fatal trigger has been drawn, and the loaded messenger has made him bite the ground."

This difference of character between the arctic and the common fox, points to a difference in prey and in manner of preying. In summer he appears to feed chiefly upon those birds which resort in such numbers to the bogs and borders of the northern marshes to breed; while in winter, when the birds are gone, and the waters frozen, he appears to resort farther upland, and subsist upon the small burrowing quadrupeds, of which there are vast numbers in that country, and many of which hybernate, and thus become an easy prey, just as the close-sitting birds do in summer when they are on their nests; the broad feet with which this species are furnished serve equally for traversing the bog in summer and the snow in winter; and the fur on the under part enables the animal to prowl with silent footfall, so as never to startle the game.

BLACK AND SILVER FOX (*V. argentatus*). The black and silver foxes are considered by the Indians to be the same kind, varying accidentally in the colour of the feet. The black are very rare, and fetch a very high price. Its skin is so rare, that Dr. Richardson says "a greater number than four or five are seldom taken in a season at any one part in the fur countries." The skins are sometimes entirely black, and are preferred when they have not any silver hairs in them; and when without any are considered the most valuable of furs, and are worth near 20% a skin.

This animal is often the size of the ordinary fox; in its entire organisation it closely resembles that well-known animal. The organs of sense, of dentition, and of generation, are the same, and its gait and movements exactly similar. It walks with its head and tail depressed. Its glances are pregnant

with distrust and penetration, and, in a word, it would be completely our European fox, if it were fawn-coloured instead of black and silver. The hair of the body and of the tail is long and tufted. Silken hairs widely dispersed, extremely fine, and of a grey, approaching to black, form the immediate covering of the skin, and the peculiar colour of the animal is owing to silken hairs which are generally of a brilliant black, though occasionally terminated by a white point, and



Black and Silver Fox.

sometimes, but rarely, altogether white. The extremity of the tail is almost entirely white, the fore part of the head and the sides are whitish, and some white hairs are detached, as it were, from all the other parts of the fur, and have no other effect than to set off to better advantage the lustrous brilliancy of the black, of which it is generally composed. The eyes are yellowish. These animals play like dogs, and like them, express their displeasure by growling. When the animal's hunger is satisfied, it conceals the rest of its food, lies down, and goes to sleep. It has a very disagreeable odour, but differs a little from that of the common fox. The exhaustion which it suffers from heat, sufficiently indicates the countries of which it is a native. Nearly all authors who have travelled in the northern parts of the old world, speak of black foxes, which has given rise to an opinion, in which there appears probability, that the species which we have been describing is to be found in both continents. Some doubt, however, must be preserved respecting their identity, until such time as it shall be confirmed by new observations, and a more exact comparison of characters.



Arctic Fox.

The foxes of the arctic countries, especially of Siberia and America, where they are most abundant, present nearly the same kind of difficulties to the systematic naturalist as the intermediately sized cats do in the tropical forests. They are all formed nearly alike, and do not differ much in size and strength; and thus the only palpable distinction is that of colour,

which of itself leads to nothing, as no means have yet been discovered by which the colours of animals can in any satisfactory way be connected with their habits.

THREE-COLOURED FOX (*V. cinereo-argenteus*). This is a native of the middle and southern regions of America. The name it may be observed might, in point of fact, be applied to the other species, as the white, the fawn colour, and the black are combined in the fur of almost all foxes. But improper as it may be, it must be retained, as it has been so long received, and as we are ignorant of the name which this animal bears in the middle and southern regions of North America. It is strange what very little care is taken by travellers to ascertain the proper names of the animals of those countries which they traverse, actually when the means of such information are entirely within their reach. The influence which such information must exercise on the progress of natural history, would give a double value to their researches. The history of any species can evidently be the result only of a very long series of observations, which it is utterly impossible for any single individual to make. To the first observations of this description the second should be naturally attached, for the purpose of giving them their just portion of utility, the third to the second, and so on, until all the necessary information is acquired. We are liable without some such plan to endless repetitions, which can produce nothing but regret for the labour which has been expended on them. The knowledge of the native name, in fact, is essentially necessary to enable us to know of what animal any traveller speaks, and of which, in all probability, he cites but a few characteristics, very insufficient for the purposes of a clear distinction. The ancients on this point seem to have been much more careful than the moderns. Such reflections as these are sure to suggest themselves to the mind, when we come to consider the foxes of North America. There are few animals of which travellers have spoken more, but there are few whose history has been treated of with less detail, and with less attention to any thing like method.

From the range of latitude over which foxes having the colours upon which this name is founded extend, we may naturally suppose that there are many varieties of colour among them. The most common markings are described thus: Upper parts of the body greyish black; head greyish yellow; ears and sides of the neck bright red; throat and cheeks white; skin black; abdomen yellow; tail yellow brindled with black and wholly black at the tip. This species or variety has been described as a South American animal by D'Azzara; and as a North American one by various authors. Its colours are those of several of the other coloured varieties blended; and therefore it may be a mongrel of many *breeds*, which word, as in the case of dogs, is in our opinion far more applicable to the differently coloured foxes, than the word "species," or even the word "variety." The distinctions between them are all too small for being useful in natural history.

THE RED FOX (*V. fulvus*). This species is not absolutely red, but of a bright reddish brown or orange. It is a native of North America, and belongs to the class of foxes which, in locality, may be considered as intermediate between the arctic ones and those of the warmer latitudes. It was long supposed that this was merely a coloured variety of the common fox; but a fine specimen presented to the Zoological

Society of London by Lord Clinton, afforded an opportunity of contrasting the two, and the following are Dr. Richardson's remarks:—

"On comparing a fine specimen of the English fox with an American fox, each was observed to have dark markings on the sides of the muzzle, posterior parts of the ears, and fore parts of the legs; the tails of both have an intermixture of black hairs, and are tipped with white. The red fox, however, differs in its long and very fine fur, and in the brilliancy of its colours. Its cheeks are rounder, its nose thicker, shorter and more truncated. Its eyes are nearer to each other; its ears are shorter; the hair on its legs is a great deal longer; and its feet are much more woolly beneath, the hair extending beyond the claws, which are shorter than those of the European fox. In short, the red fox differs from the European one in nearly the same characters that distinguish the grey American wolf from the Pyrenean one, in the breadth and capacity of its feet for running on the snow, the quantity of long hair clothing the back part of the cheeks, which in conjunction with the shorter ears and nose, give the head a more compact appearance. The red fox has a much finer brush than the European one, and is altogether a larger animal."

There are, however, so many foxes in the wilds of America, especially in the northern part of that continent, and they differ so much in colour in some of the specimens, approach so nearly in others, and are so exactly the same in structure, and so nearly the same in manners, that it would be no easy or perhaps even possible matter to form a systematic arrangement of them; and after such an arrangement had been formed with the greatest care and discrimination it would be of very little value; because it belongs to that class of minute distinctions which lead to no conclusion, and which are serviceable only in so far as they enable the showman to give a different name to every animal in his living collection, or to every skin in his museum, which may happen to have different colours and markings from others. The following observations by the eminent naturalist from whom we have just quoted, are very much to the purpose. "Foxes," says Dr. Richardson, "are distinguished by the traders under the names of black, silver, cross, red, and blue foxes. The two former are considered by the Indians to be the same kind, varying accidentally in the colour of the pelt. The black foxes are very rare and fetch a high price. The cross and red foxes differ from each other only in colour, being of the same shape and size. Their shades of colour are not disposed in any determinate manner, some individuals approaching in that respect very nearly to the silver fox, others exhibiting every link of the chain down to nearly a uniform deep or orange-yellow, the distinguishing colour of the pure red fox. It is reported both by the Indians and traders, that all the varieties have been found in the same litter. The blue fox is seldom seen here, and is supposed to come from the southward." The case of the fox is by no means a solitary instance of confusion introduced into the nomenclature of animals, by those who hunt wild ones without any reference to science.

THE LITTLE YELLOW FOX (*V. corsac*) is smaller than the common fox, and the localities which it inhabits are of a different character. It is not found in woods or thickets, but in the open wastes. With some differences of appearance, it seems to extend from the steppes of Siberia to central Africa; and may be the

"little fox" alluded to in the bible, though the accusation against the little foxes there is that they "spoil the vines," and there are no vines, at least in the native localities of this one. The general colour is greyish yellow, with some waving streaks of black at the root of the tail, and the tip of the tail is also black. The place where this fox has been seen in the greatest abundance, is on the steppes between the mountains of Ural and the west end of the Altaian chain. They are so numerous on the wide plains there, that according to Pallas, not fewer than fifty thousand skins have been procured in a single season in the province of Orenburg alone. They are also found very abundantly on all the dry and extensive plains of central Asia, and appear to follow the line of the arid wastes on the margin of the deserts as far as the sources of the White Nile. It is probable that they are found also on the dry plains of the north of India; but the fox of the south of that country, or of the Deccan, is described as being somewhat different. The following is the account of it, as given by Colonel Sykes, to whom we are so much indebted for a knowledge of the animals of the Deccan.

The KOKREE (*V. kokree*; *Canis kokree*, Sykes.) "Upper part reddish grey, under dull white, tail brushy, with the tip black, feet reddish, and pupil of the eye elongated.

"The fox of Dukhun appears to be new to science, although it much resembles the descriptions of the corsac. It is a very pretty animal, but much smaller than the European fox. Head short; muzzle very sharp. Eyes oblique; irides nut brown. Legs very slender; tail trailing on the ground, very bushy. Along the back, and on the forehead, fawn colour; with hair having a white ring near to its tip. Back, neck, between the eyes, along the sides, and half way down the tail, reddish grey, each hair being banded black, and reddish white. All the legs reddish outside, reddish white inside. Chin and throat dirty white. Along the belly reddish white. Ears externally dark brown, and with their fur so short as to be scarcely discoverable; edges of eyelids black; muzzle red brown." The length from the muzzle to the tail is from twenty-two inches to twenty-two inches and a half; and that of the tail itself from eleven inches and a half to a foot. The foxes of the corresponding latitudes of Arabia and Africa have not been examined with much care; but from the account given by Rüppell, it should seem that the Nubian fox very closely resembles this one, and that they differ from the small fox of the dry plains of the northern and central plains of America, chiefly in being smaller in size and having the fur on the body less produced; but, even in the warmest latitudes, they retain their brush in its full perfection, which shows that this peculiar production of the tail and its covering answers some very important purpose in the economy of foxes, though what this purpose is has not hitherto been ascertained,—indeed, we want a good philosophical account of the tails of animals.

The CAPE FOX (*V. mesomelas*). This species from its name is, of course, South African; and it appears to resemble the last-mentioned in some particulars; though there are some doubts about it. It has a long bushy tail, and elliptical pupils according to some; while, according to others, the pupils are round. If the first are correct, it is a fox; if the second, it is a jackal.

The CROSS FOX (*V. decussatus*), is considered by Cuvier as only a coloured variety of the common fox,

which it resembles in size and in manners; but, in our uncertainty as to the species of foxes, it is worthy of a separate notice. The prevailing colour on the upper part is blackish grey, produced by hairs with alternate rings of white and black. This colour also extends to the outer parts of the legs, but these have less white. There is a black cross on the shoulders, from which the trivial name is obtained. It has been principally found in North America, where it inhabits far to the northward, and is found on the shores of the Arctic Sea, not only on the American side of the Straits, but also on the Siberian. Indeed, from the proximity of the two continents at this place, from the ice in the strait forming a regular bridge every winter, and there being a permanent one from thence to the north, it is natural to suppose that foxes which, though not migratory, are ranging animals, and which, as they do not migrate, may naturally be supposed to disperse in the winter, when food for them is not abundant in any one locality, will pass readily from the one continent to the other, so as to be very little different in both. They also, in all the species probably, are subject to seasonal varieties, both in the length and closeness, and in the colour of the fur. Thus at certain seasons, or at all events, in certain individuals, the fox, which is usually called white and silver, from the grey on the points of the hairs, is found entirely black. In this state it is rare, and this also seems to be the prime condition of the fur in point of beauty; the old coat entirely gone, and the new one fully grown, but not begun in the least to fade or become dry, so that it has more gloss than at any other period. It seems also, that, whatever may be their variety as to colour, foxes acquire a much thicker winter covering, in proportion as they inhabit places which are colder, and this not only over the body, but on the soles of the feet. Not on the pads, because these are not fitted for producing hairs, as they are without the papillæ from which those appendages grow. But the inner and under sides of the toes, and the spaces between the pads, produce fur of so lengthened a character, that it seems to cover the entire sole of the foot, at least that part of it which comes in contact with the snow. The numbers of those animals in the northern regions are immense; their skins are of great value; and we believe that their flesh is very wholesome, and might be cleared of the foxy odour by being buried a short time in the ground. The northern people are not, however, very delicate in their tastes.

FOX-BANE. Is the *Aconitum vulparia* of Reichenbach, a common plant found wild on the European alps, and belongs to the natural order *Ranunculaceæ*.

FOX-GLOVE. Is the *Digitalis purpurea* of Linnæus, a handsome and very common British plant, abundant on hedge-banks everywhere. It belongs to *Scrophularinæ*.

FOX-TAIL GRASS. Is the *Alopecurus pratensis* of Linnæus, one of our most useful meadow-grasses, and one of the principal species employed in laying down permanent pastures.

FRAGARIA—Strawberry. A genus of European herbs, yielding delicious fruit. The flowers are icosandrious, and belong to the natural order *Rosaceæ*. The strawberry has been long in cultivation, and many excellent varieties have originated under the practical skill and care bestowed on their culture. The best and most convenient season for forming a new plantation of strawberries is the month of Au-

gust, because then the young plants produced on what are called runners from the old stocks are fit to be separated from the parent, each having roots of its own. The best soil for the generality of the varieties is a mellow loam, but almost any kind of garden soil in good heart is suitable. The ground intended to receive them should be trenched or double-digged, and the surface enriched with some good rotten dung. The usual order of planting is on beds of four and a half feet wide, on which four rows of plants at twelve inch distances between are dibbed at like distances between plant and plant; this allows margins of three inches on each side. The beds are separated by two feet wide alleys, to allow of weeding, watering the plants, and of gathering the fruit.

The strongest runners are always chosen for transplanting, and in order to obtain them as strong as possible a shallow trench is made between the rows of old plants, and filled with a rich compost. On this the first runners are laid and fastened down by little hooks. The runners quickly strike roots into this compost, and grow strongly. To encourage them still more they should be watered along with the mother plants in dry weather. When the season arrives for transplanting, the young plants rise with fine roots, and strong enough to promise a good crop in the following year.

The beds are never dug between the plants, but only kept clear of runners and of weeds by the hoe. The alleys are dug every winter, and a little of the fresh soil from them thrown over the beds as a top-dressing. It is usual to lay straw, or some kind of clean loose litter, round the plants before the fruit begins to ripen, to save them from being dashed with earth by rain or when watered. When young plants are not wanted, the bearing plants should be kept free from runners lest they rob the swelling fruit.

This plan of keeping every mother plant distinct and separate, is most suitable for the larger sorts; the alpine, and sometimes the hautbois are planted individually at first, but afterwards allowed to run all over and occupy the whole surface, in which state these kinds will, in somewhat shady situations, do very well, and continue productive for several years.

Some cultivators, instead of beds, plant the large sorts in open order, say two feet apart every way on well prepared ground, knowing that the more space each plant is allowed the stronger it will grow and flower, and bear fruit in greater numbers, and of greater size. Besides, the side branches of the mother-plant (not the runners) have room to extend and yield fruit in as great quantity as the principal crown. To understand this result rightly, it is necessary to advert to the constitutional character of the strawberry plant. The plant is compound; that is, it is composed of a principal and central division, which yields flowers and fruit in the next year after it is formed. This principal is surrounded by a secondary set of branches, which also in time yield flowers and fruit superseding the first, which decays and disappears after it has ripened its fruit. The secondary set of branches, or divisions, of the system put forth, in their turn, a tertiary birth of branchlets, which also in time are fruitful: and these again a fourth set of offsets, which process is continued for ever, if the plants are not destroyed by accident or by each other. During this process, the system from this annual subdivision becomes weaker and weaker, so that at last the flowers are so few and

diminutive, that the crops are unprofitable, and not worth their place in the garden.

This is so well known to cultivators, that they do not consider a strawberry plantation worth its place after the third year, and many take only two crops from the plants, trenching them down as soon as the crop of the second year is gathered. Here it may be asked, how is it that plants allowed to occupy the whole surface of the ground are suffered to be usurpers? The answer is,—to save trouble, and as some of the runners are always yielding fruit for the first time, these being passable as to size and flavour, guarantee the preservation of the whole.

Strawberries are often planted in single rows by way of edgings to borders. In this way they have the advantage of full air and light, which is so far suitable, as well for increasing the size, as for the convenient gathering of the fruit. People of fortune, who wish to have the fruit in the highest perfection, are at the expense of paving the whole surface of the beds, leaving holes for the reception of the plants. Others erect beds of brick-work formed like a ridge, the sides graduated like steps, on which the plants are placed in apertures left to admit the roots into the compost on which the bricks are laid. These beds have a contrivance for the purpose of irrigation, which is of great service during the flowering season. There is a trough formed of the brick-work along the ridge, which being intentionally leaky allows the water to percolate down the sides without wetting the flowers or fruit. The reflected light of the sun from the bricks serves also to ripen and improve the flavour of the fruit.

Potted strawberry plants may be forced either on hot-beds, pits built for the purpose, or in almost any description of forcing-house, provided air, light, and water enough can be given. On hanging shelves in a peach-house or vinery they do well, so as they are kept as near the glass as possible, and be not placed in pans, stagnant water being hurtful to the roots.

Strawberry plants which have been forced are often consigned to the rubbish heap, but by bestowing a little care on them they may be made doubly serviceable. It should be considered that the primary bud of the crown has only yielded fruit, and the secondaries being at the same time advanced, they therefore only require to be turned out of the pots into good soil, in a north or east aspect, where they will make new roots, and give a small crop of fruit in the autumn. This crop, indeed, is neither so large nor so finely flavoured as the summer fruit, but they give variety to the dessert, and are always useful to the confectioner.

An autumn crop of strawberries may be obtained by a very simple expedient; viz. by divesting the plants of all their first flowers, which will cause those of the side branches to be soon afterwards developed, and which will give their fruit in the autumn. This will, however, be at the expense of the next year's crop.

The most esteemed sorts of strawberries are the following, viz. :—

The *Alpine* red and white are both of weakly growth, and yield fruit from well-established plants from the end of June till November. A light chalky soil suits them best; and as they succeed the earlier sorts, they are usually planted on north borders, in order to prolong their fruiting season.

The *Virginian*, or scarlet pine, is universally cultivated; it affects a strong and rather rich loam; is

an early sort, and forces well. It requires an open airy situation.

The *Roseberry* is a variety of the preceding: very fruitful, and grows to a large size. This also requires rich loam and an open situation.

The *Chili* bears a large and well-flavoured fruit, but without much colour. It grows strong, and requires ample space and good ground.

The *Keen's seedling* bears a large showy fruit, and is much esteemed in the market as well as at table.

The *Pine* is a new variety, and much cultivated in the neighbourhood of London. It requires to be planted singly in very open order. A loamy soil and open exposure is most suitable to both this and the *Imperial*, a kindred variety also much esteemed.

The *Hautbois* is an old sort, valued for its high and peculiar musky flavour, and when well grown is certainly one of the best. There is a peculiarity in the flowers of this sort unlike its congeners; some of the plants being destitute of female organs—of course barren. These barren plants, however, are not without their use, for it is found, if duly interspersed with the others which are defective in their stamens, good and plentiful crops will be obtained. In making a new plantation of the hautbois, both the male and female plants should be carefully mixed in the rows to insure success. Air and light are particularly necessary to this sort; and if the flowers and trusses of fruit be tied up to little stakes, so that they may be above the leaves, matures them perfectly.

There are several other new varieties of strawberries lately brought into cultivation; such as Knyvett's *New Pine*, *Grove End Scarlet*, *Downtons*, &c., all requiring similar management.

Soon as strawberries begin to be scented, they are eagerly preyed on by snails and slugs, to the depredations of which their position near the ground and dense covert of foliage subject the fruit. To prevent these animals harbouring about the plants, the beds or rows should be two or three times, during the months of March and April, well watered with lime water. This will, probably, either kill or banish them before the fruiting season.

FRANKENIA (Linnæus). A genus of creeping perennials found in different parts of the world, two of them being British. One is called sea heath, and belongs to the sixth class of Linnæus, and the natural order to which they give a title is described beneath.

FRANKENIACEÆ. A natural order, containing only a few genera and species, chiefly hardy herbs,



F. pulverulenta.

nearly allied to *Caryophyllæ*, from which it is distinguished by the fruit not having a central separate placenta, but bearing the seeds on the inner margin

of the valves. They are plants of no beauty, and have no known medicinal qualities.

FRATERCULA—Puffin. A genus of web-footed birds, belonging to Cuvier's division of *Brachypteres*, or short-winged birds; and generally, though improperly, included in the genus *Alca*, the penguin; but the characters are sufficiently different for warranting the separation of this species from the others.

The following are the generic characters: bill shorter than the head, deeper than long, and much compressed; both mandibles arched, transversely channelled, and notched towards the tip, the upper sharp-ridged and elevated above the level of the skull; the nostrils lateral, marginal, linear, naked, almost wholly concealed by a large naked membrane; legs short, placed far behind, furnished only with three toes, all directed forwards and webbed, claws much hooked; wings short.

In their general habit they bear some resemblance both to the guillemots and the penguins; but they are less addicted to flying than the former, and, generally speaking, better winged than the latter, with the exception perhaps of the common auk or razor-bill. They, however, skim along the surface of the sea with considerable swiftness; but they are bad walkers, and not found inland, though of course they, like other birds of the same class, resort to the shores in the breeding time.

They are all inhabitants of the colder seas of the northern hemisphere; there being at least three species, one more common on the north of the Atlantic, another on the north of the Pacific, and a third on the shore intermediate between the two oceans, at least in the American part.

COMMON PUFFIN (*F. arctica*). This species is well known upon many parts of the British coasts; and its singular appearance and loud screaming cry have got it an endless number of local names, to which, in the case of this bird, it is necessary to pay some attention, although it is so constant to its type that when it is fairly seen there is no chance of mistaking it. The following are the characters: the bill compressed, two-edged, upper mandible with three grooves, the under with two, orbits and temples white, upper eyelids daggered or furnished with a pointed callus. The mature male and female, both in their winter and summer dress, have the crown of the head, all the upper parts, and a broad collar, deep and glossy black; the quill-feathers dusky brown; the breast, belly, and lower parts, pure white. Length about twelve inches and a half, extent of wing twenty-one inches, weight about twelve ounces. The bill, which imparts such an appearance of novelty to this bird, varies considerably according to its age; for in the first year it is small, weak, destitute of any furrow, and dusky; in the second year it is larger, stronger, of a paler colour, and discovers a faint vestige of a furrow near the base; but in the third and more advanced years it exhibits great strength and vivid colours. The whole plumage is remarkable for its closeness; and the bird is very compact in its form; and when it sits on the point of a rock, just above the surface of the water, with its head in the position which heralds call "regardant," it makes rather a handsome appearance, as may be seen in the representation beneath. It does not appear that these birds, notwithstanding the great power of their bills, prey upon large fishes, though in all probability they consume vast numbers of the

small fry, because they are observed to be very active in those turbulent states of the water near the shore, in which the fry lose command of themselves, and are easily captured. Their principal food, however, seems to be the smaller crustacea and shelled mollusca, and the great strength of their bill enables them readily to bruise the former, and break the shells of the latter. In respect of their feeding, they probably form one extreme of the diving birds, being less officious than any of the others, but having the bill better adapted to act as a bruising instrument than any other sea birds whatever. They use the bill, and that very powerfully, in their own defence; but except in the breaking up of that small food on which they subsist, it does not appear that they use it for any purpose of attack.



Common Puffin.

Puffins are abundantly found in all the northern seas of Europe, Asia, and America, and there are many of them, during the summer at least, on the shores of Spitzbergen; but of course they retire from those northern haunts during the winter; and indeed at this season they quit the neighbourhood of their nesting places, and become discursive over the sea, as is the case with all those aquatic birds which resort in great numbers to particular spots of the coast during the breeding season. In their southern progress they have been found about Belleisle, in the Gulf of Gascony. As they take flight with great difficulty, they are sometimes run down by boats, or driven ashore, when suddenly caught in a gust of wind; but they can fly very well when they get on the wing. They appear in many parts of our rocky coasts about the middle of April, and commence breeding towards the middle of May. On the Dover cliffs, and other such places, they deposit their single white egg in the holes and crevices; but in other situations they burrow like rabbits if the soil is light, or more frequently take possession of a rabbit's hole, and lay their egg some feet under ground. On St. Margaret's island, off St. David's, the fishermen put their hands into the holes, and the puffins seize them so obstinately, that they allow themselves to be drawn out. The Orcadians drag them out with a stick, to the end of which is attached an iron hook. The flesh of the old bird is both rank and fishy, but the young ones, which are seized before they are quite fledged, when pickled and preserved with spices, are much relished by some, and are allowed to be eaten in Roman Catholic countries during Lent. In some places they are taken with ferrets. The males, as well as females, perform the office of sitting, relieving each other when they go to feed. The young are hatched in the beginning

of July, and the re-migration of the species takes place about the middle of August, when none remain behind, except the unfledged young of the latter hatches. In one part of Akaroe, a small island off Iceland, puffins breed in vast numbers, forming holes in the mould three or four feet beneath the surface.

In the Faroe islands puffins are also very numerous; and the young, and indeed the old birds, are eagerly sought after as articles of food; in the capture of these birds, and the other nestlers in the rocks, the Faroese undergo the greatest hardships, and expose themselves to the most imminent dangers. The following account of their labours in this way, chiefly drawn up by Sir George Mackenzie, who visited these islands in 1812, cannot fail to be read with interest. "The fowlers," says Sir George, "are provided with long poles, to the ends of which are fastened small rope nets. With this instrument they generally display great dexterity in casting it over the birds, which invariably make towards the water when disturbed. It is this anxiety of the birds to seek the element in which their security is to be found, which gives certainty to the exertions of the fowler. The birds push their heads through the meshes of the net, which, being dexterously inverted, keeps them suspended by the neck. When a fowling expedition is undertaken, two men fasten themselves to a rope, so that there may be eight or ten fathoms of it between them. One assists the other to ascend the rope by means of a pole, at the end of which is a hook, which is fastened to the band of the climber's breeches, or to a rope tied round his waist, and thus he is pushed up; but the most common method is for the climber to seat himself on a board fastened to the end of the pole. They often ascend frightful cliffs without any assistance. When the first has got to a place where he has some footing, he helps the other up by means of the rope to which they are both fastened. When they have gained the elevation where the birds are pretty numerous, they assist each other from cliff to cliff. It sometimes happens that one of them falls and pulls the other after him, when both are precipitated into the sea, or dashed to pieces on the projecting rocks. When the rocks are so high and smooth as to render it impossible for the fowlers to ascend, they are let down by means of a strong rope from above. To prevent the rope from being cut, a piece of wood is placed at the verge of the precipice. By means of a small line the fowler makes signals to those above, and they let him down or pull him up accordingly. When he reaches a shelf of the rock where the birds have their nests, he unties himself, and proceeds to take them. Sometimes he places himself on a projecting rock, and, using his net with great adroitness, he catches the birds as they fly past him, and this they call veining. This mode of catching birds is even practised while the fowlers are suspended. When a projection of the rock is between the fowler and the place where the birds are, he swings himself from the rock so far that he turns round the projection. In this, great address and courage are requisite, as well as in swinging under a projection into a cavern. When he cannot with the help of his pole swing far enough, he lets down a line to people stationed in a boat below, who swing him by means of it as far as is necessary to enable him to gain a safe place to stand upon. Besides being exposed to the risk of the rope breaking, the fowler is frequently in danger of being crushed by

pieces of the rock falling down upon him." The eggs of the common puffin are also held in considerable repute as articles of food; but as there is only one in the nest hole, as that hole is deep, and as after the egg is dropt one of the birds is usually there, prepared to seize whatever is intruded, the plunderer of a puffin's nest requires either hard fingers or a thick glove. With either of these, however, the bird may be easily drawn out.

THE CRESTED PUFFIN (*F. cirrata*) has the upper part of a bluish black, and the under dull brown; the front, the sides of the head, the chin, and part of the coverts, pure white. There are tufts of long thread-like feathers which rise over the eyes, and dividing into two parts, bend over the sides of the neck. These feathers are white at their bases, but yellowish at their points. There are three furrows in the bill; and a cartilaginous cere at the base of the bill, forming a sort of rosette at each angle of the gape; the tarsi and toes are bright orange-yellow, the webs of the feet red, and the claws black. These are the characters of the male bird; and the length of that species is about nineteen inches. The female is rather less, has a smaller crest, and has only two furrows in the bill, but in other respects the sexes are pretty similar.

This species is chiefly found in the sea of Kamtschatka, both on the American and the Siberian side, and also on the shores of the Aleutian islands; but it is probable that, like their congeners of the Atlantic, they migrate southward during the winter. Their bills are even more powerful than those of the others, but their food is nearly the same, being chiefly crustaceous animals and shelled mollusca. They are exclusively day feeders, and though, like the former, they are sometimes found sitting on rocks watching for their prey, they seldom come to land, except during the night. They lodge in holes of the rocks, or in burrows which they themselves excavate in the dry banks, which are generally between three and four feet deep, and no wider at the entrance than will just admit one of the birds, but farther in it is wider. One egg only is produced at a brood, which is rather larger than that of a common duck. This species and the former are not found in the same seas; and though their manners are very similar, they appear to be properly entitled to rank as distinct species.

NORTHERN PUFFIN (*F. glacialis*). This species inhabits more northerly than any of the others, and has not been observed except in the Polar Sea, or even there, but on the north coast of America. Among the dreary islands in that region it is, however, one of the most northerly birds. The upper part of it is black, with a collar nearly as large as that of the common puffin; the cheeks and sides of the head are greyish white; the quills brown; the under part white; the upper mandible of the bill very much elevated, and with three furrows; the inferior mandibles strongly arched; the feet orange-yellow; webs red; and the claws black. The length is nearly the same as that of the common species, being about a foot or thirteen inches. The probability is that its manners differ but little from the one with which we are familiar on the shores of this country; but there is not much known respecting it.

FRAXINELLA. Is the *Dictamnus fraxinella* of Persoon, an ornamental herbaceous perennial, a native of Germany, a border plant in flower gardens, and is easily propagated by seeds.

FRAXINUS (Linnæus). A genus of hardy deciduous trees, natives of Europe and North America. They are polygamous, and belong to the natural order *Oleina*. Generic character: calyx four-parted or none; corolla of four petals four-parted or none; stamens short, anthers oval, two-celled, bursting outwardly; stigma nearly sitting, bifid; fruit two-celled, compressed, winged at top. For an account of the mode of cultivation, see ASH.

FRINGE TREE is the *Chionanthus Virginica* of Linnæus. A deciduous flowering shrub or tree, a native of North America. The flowers are elegant, and the plant has always a place in ornamental plantations.

FRINGILLIDÆ—the Finch family. A very numerous and interesting group of small birds, in some or other of its many species, inhabiting all parts of the globe, and constituting the tribe or sub-order *Conirostres* of Cuvier. They are all seed-eating birds, some, however, being much more exclusively so than others, whose grand office in the economy of nature is to assist, and that in no small degree, in keeping down the excess of certain forms of vegetation, subsisting on the germs of life, so copiously and abundantly distributed by various plants, chiefly of the composite and cruciform races, the extreme and exuberant fertility of which would otherwise enable them to usurp dominion over every other, and so monopolise the soil as to render it unfit for cultivation. The adaptation, however, as in all other similar cases, is of course mutual, and the apparent superfluity of seeds which are annually produced thus enables thousands and millions of beings to enjoy existence—to enliven and diversify the face of nature with moving life, and to cheer the still monotony of vegetable beauty by their lively and inspiring songs of joy and happiness. They, in their turn, furnish food to other races; and there are several of the smaller birds of prey which draw their chief subsistence from the various tribes, which, together, constitute the comprehensive and very natural *family* of which we have now to enter upon a description.

The general character, or that which is the most typical of the group, is to have a sharply-pointed, conical, and, in most cases, a strongly-formed bill, the upper mandible of which advances a little upon the line of the forehead; the *tomia*, or cutting edges of the mandibles, are always more or less bent inward, those of the under one more particularly; and the bill is endowed with great power of compression, the mandibles having a separate motion, and the under one having besides, a considerable lateral movement, by means of all which, and with the assistance of the tongue, the birds are enabled to crack with facility the husks of very hard seeds, and to shell them, rejecting the envelope while the kernel remains in the mouth; the feet have three toes before, and one behind, all of which are entire, and separate to their full extent, and they are adapted either for perching, or for progressive movement; upon the ground, this movement is, in most of the species, performed by hopping, though some of them can move forward only by alternate steps, while a few advance alike by either method; these latter, however, have neither movement in such perfection as those which are confined to one only.

As a group, the plumage may be described as being generally of a firmer texture than in the insectivorous races, their colours and markings being more decided, and the male is in almost every

instance clad in a much brighter livery than the hen bird, the difference being most conspicuous in summer, as at the autumnal renovation of plumage the new feathers are each fringed with a dusky edging, which gradually wears away from the bird in the ensuing season.

The species are, however, so very numerous, that it is difficult to mention any general character which will apply alike to the whole group, which therefore can be satisfactorily described only in its subordinate divisions separately. There are five or six leading modifications in the form of the bill, some of which are accompanied with very slight differences in the other general characters. The family may be said to commence with the *Tanagrinae*, or *Tanagers*, a division pertaining exclusively to the American continent, and comprising several genera and a considerable number of species, most of which are adorned with splendid, some with most gaudy, colours, and which are by far the most insectivorous of the finch family, subsisting chiefly upon beetles, grasshoppers, and the other larger insect tribes; but they shall grain with the same facility as the other *Fringillidæ*. In this division, as might be expected, we find many traces of the *Dentirostral* character (see article BIRD); and indeed there is a regular and unbroken series of forms connecting these birds with certain of the cotinga family (*Ampelidæ*), a group belonging to the *Dentirostres*, and the great majority of members of which inhabit the same countries, and display equally rich and showy plumage with the *Tanagrinae*. In one genus of the latter, *Pyreya* of authors, the *Dentirostral* character is indeed pretty well made out; but this division will be more conveniently described in detail in a separate article, TANAGER.



Painted Nonpareil.

Immediately following these, and connecting them with the more typical finches, we have the genus *Spiza*, of C. L. Bonaparte, also inhabiting the new world, and containing birds of very bright and showy plumage. Its characters are intermediate between those of the *Tanagers* and more typical finches, and, like the former, they would appear, from Wilson's description of his "painted beauties" (or, to give it a more definite name, painted *nonpareil*, *Spiza cisis*),

to be very insectivorous. This gaudy little bird is often imported into this country, and live specimens of it may be procured at several of the London shops in which foreign birds are kept for sale. It is about the size of a goldfinch; the head, and upper part and sides of the neck, are bright purplish blue; eyelid, chin, and all the under parts, vermilion; back and scapulars glossy yellow, stained with rich green, in the older individuals with red; lesser wing-coverts purple; larger green; wings dusky red, sometimes edged with green; rump and tail-coverts bright red; tail, which is slightly forked, sometimes of a purplish brown, sometimes green; legs and feet leaden grey; bill black above and bluish below; irides brown. Such are the brilliant tints of one of the commonest birds of the more southern of the United States of America.

These birds are caught in great numbers by the American bird-catchers, and kept in confinement on account of their beauty. The mode of catching them is somewhat curious, as described by Audubon:—"A male bird, in full plumage, is shot, and stuffed in a defensive attitude, and perched among some grass-seed, rice, or other food, on the same platform as the trap-cage. This is taken to the fields, or near the orangeries, and placed in so open a situation that it would be difficult for a living bird of any species to fly over it without observing it. The trap is set. A male painted finch passes, perceives it, and dives towards the stuffed bird, brings down the trap, and is made prisoner. In this manner thousands of these birds are caught every spring; and so pertinacious are they in their attacks, that, even when the trap has closed upon them, they continue pecking at the feathers of the supposed rival."

This species is described by Wilson to be one of the most numerous of the little summer birds of Lower Louisiana, where it is universally known among the French inhabitants, and called by them *le Pape*, and by the Americans *the Nonpareil*. "Its gay dress and docility of manners," he says, "have procured it many admirers, for these qualities are strongly attractive, and carry their own recommendation along with them. The low countries of the southern states, in the vicinity of the sea, and along the borders of our large rivers, particularly among the rice plantations, are the favourite haunts of this elegant little bird."

The same naturalist has furnished us with a detailed account of another species, the *Indigo Nonpareil* (*Spiza cyanea*), another beautiful summer visitant of the United States. "This is another," he observes, "of those rich-plumaged tribes that visit us in spring from the regions of the south. It arrives in Pennsylvania in the second week in May, and disappears about the middle of September. Notwithstanding the beauty of his plumage, the vivacity with which he sings, and the ease with which he can be reared and kept, the *Indigo* bird is seldom seen domesticated."

According to Bechstein, the song of this bird resembles considerably that of our common linnet.

The *Lazuli Nonpareil* (*Spiza amona*) is also a splendid species, which appears to be rather rare, and more limited in its locality than the others. It resembles the *Indigo* bird in size and habits, and is found, during the summer months, along the Arkansas river, near the base of the Rocky Mountains, where it is described to frequent the bushy valleys, keeping

generally in the grass, and seldom alighting on trees or shrubs. The whole head and neck of the male are brilliant verdigris blue; the back brownish black, intermixed with blue; breast ferruginous, becoming pale as we descend; wings variegated with black and blue, with two white bars across; bill and feet horn colour.



Reed Bunting.

Allied to these birds, and connecting them, on the one hand, with the linnets and other typical finches, and, on the other, with the pine bullfinches and crossbills, we have the genus *Erythropsiza*, containing a number of species so similar in plumage, as to be told apart with difficulty, and in which the predominating colour is red, of various shades of hue and brightness. They have a very wide range of geographical distribution, one or two species being found in Africa; but the majority of them inhabit the more northern parts of Europe, Asia and America. We know little of their habits beyond the minute and accurate description which Wilson, the ornithologist of the United States, has furnished us with concerning the only species which he enjoyed opportunities of observing. As described by him, their habits seem intermediate between those of the common linnet and bullfinch of this country.

One species abounds in winter in the United States, *Erythropsiza purpurea*, described by Wilson, under the name of purple finch. "This," he observes, "is a winter bird of passage, coming to us in large flocks, from the north, in September and October; great numbers remaining with us in Pennsylvania during the whole winter, feeding on the seeds of the poplar, button-wood, juniper, cedar, and on those of many rank weeds that flourish in rich bottoms, and along the margin of creeks. When the season is very severe, they proceed to the south, as far at least as Georgia, returning north early in April. They now frequent the elm trees, feeding on the slender but sweet covering of the flowers; and as soon as the cherries put out their blossoms, feed almost exclusively on the stamina of the flowers; afterwards the apple blossoms are attacked in the same manner, and their depredations on these continue till they disappear, which is usually about the tenth or middle of May." Among the *Fringillidæ* of Europe, many feed very much upon

the unopened blossoms of various plants; the goldfinch and linnet for example, on those of the furze, but the common bullfinch (so far as the writer of this has observed), is the only species which attacks and devours the fruit blossoms, and the depredations which two or three of these beautiful birds will commit in a garden in the course of a few days, are by no means inconsiderable. In England we have hardly so destructive a bird in the orchards as the common bullfinch, and the purple finch appears in America to perform the same part which this species does with us. "These birds," Wilson continues, "fly at a considerable height in the air, and their note is a single *chink*. They possess great boldness and spirit, and when caught bite violently, and hang by the bill from your hand, striking with great fury; but they are soon reconciled to confinement, and in a day or two are quite at home. I have kept a pair of these birds upwards of nine months to observe their manners. One was caught in a trap, the other was winged with a gun; both are now as familiar as if brought up from the nest by the hand, and seem to prefer hempseed and cherry blossoms to all other kinds of food. Both male and female, though not crested, are almost constantly in the habit of erecting the feathers of the crown; they appear to be of a tyrannical and domineering disposition, for they nearly killed an indigo bird, and two or three others that were occasionally placed with them; driving them into a corner of the cage, standing on them, and tearing out their feathers, striking them on the head, munching their wings, &c., till I was obliged to interfere; and even if called to, the aggressor would only turn up a malicious eye to me for a moment, and renew his outrage as before. They are a hardy vigorous bird." The males are all over dark crimson, deepest on the head and chin, and lightest on the lower part of the breast; back streaked with a dusky colour, and wings and tail dusky black, the latter considerably forked. The female is of a brown olive, or flaxen colour, streaked with dusky black, and having also a little whitish about the head and under parts.

"A male," says Wilson, "of one of these birds, which I kept for some time, changed in the month of October from red to greenish yellow, but died before it recovered its former colour." There is something very obscure in the changes of hue which most finches exhibit which are tinged more or less with red. Those of the common linnet, and its more immediate congeners, we shall describe presently; in them the red invariably disappears entirely after moulting in the cage, and the approach of the breeding season, though it excites them to song, and, although they breed very readily in confinement, never brightens their plumage, in the least degree, as is the case when they are flying wild. In a state of nature, they push forth dark brownish-red feathers in autumn, which in spring change rather suddenly to bright scarlet; but the purple finch appears in winter to be clad in a garb of bright red, so that the fact of Wilson's bird changing by moulting into "greenish yellow," seems rather to have been an effect produced by the unnatural state of confinement; and it is very probable that it would never afterwards have assumed its red plumage in the cage.

A species closely allied to the purple finch, and which Wilson erroneously supposed to be identical with it, is the *Erythropsiza rosea*, an inhabitant chiefly of northern Europe, but which is also found occasionally in arctic America. Its form and plumage, and,

in all probability, its habits, much resemble those of that bird; and Temminck describes it to frequent the neighbourhood of rivers, particularly in Siberia: in winter it visits the eastern parts of the south of Europe, and is now and then observed in Hungary.

The crimson-crowned finch, *Erythropsiza erythrina*, is another European species, but found chiefly within the arctic circle, it does not, however, appear that it has yet been noticed in America, though the following species, nearly allied to it, is rather plentiful in the district of country extending along the base of the Rocky Mountains.

CRIMSON-NECKED FINCH (*E. frontalis*), has been figured and described in C. L. Bonaparte's continuation of Wilson's work. This bird is only one remove from the pine grosbeak, or as it is termed by some authors the pine bullfinch (*Corythus enucleator*). It so resembles the *E. erythrina*, also, that it requires some acumen to distinguish these apart, at least in the state of stuffed specimens. There are many circumstances, however, which tend to indicate that they are distinct and separate species. All the birds of this genus so nearly resemble each other, that their specific differences are still involved in great confusion, and it is probable they may long continue so, unless we have some better data for determining these separate characters than dry and distorted skins. The four northern kinds, however, which are here mentioned, may be considered as pretty well made out, as also three or four others, of which, however, nothing more is at present known, except the names.

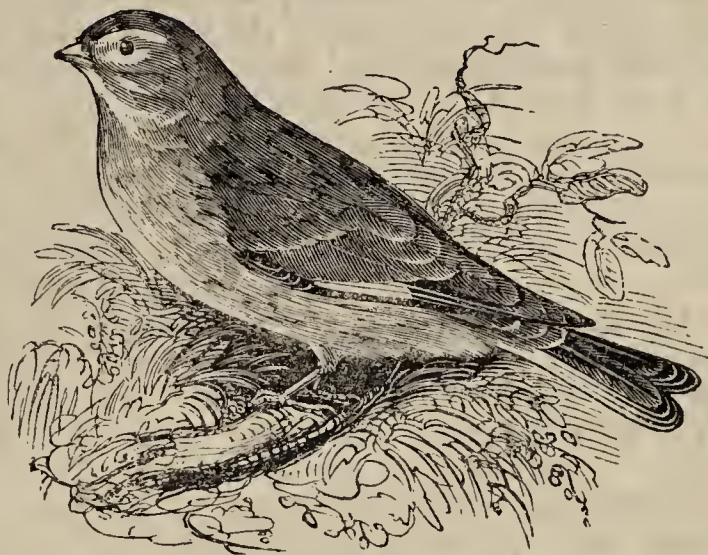
We next come, in a regular series, to the pine bullfinch of authors, a large species inhabiting both continents, and much more closely allied to the last mentioned birds, and to the cross-bills (*Loxia*), than to the true bullfinches, with which it has generally been associated. It is, in fact, a true *loxia* in all respects, excepting the bill, and undergoes the same very peculiar changes of colour; the young birds, which have once moulted, being clad in a much brighter livery than they ever wear afterwards. Like the crossbills, it is an inhabitant of the northern pine forests, out of which it is hardly ever found; but as it has generally been considered as a bullfinch, from a slight resemblance in the form of the beak, it will be more convenient to describe it along with the true bullfinches, in the general article PYRRHULÆ. The true bullfinches have the plumage altogether of a different character and texture from this species; and, though considered as the type of a division of the *Fringillidæ*, to which the name *Pyrrhulinæ* has been given, and in which the crossbills and *erythropsizæ* are usually placed, they do not appear to have any considerable degree of direct affinity with any of the others.

The crossbills (*loxia*) connect the pine bullfinch with the siskin and redpole linnets, to which they are much more nearly allied than would be supposed from a mere casual glance at stuffed specimens. Four species of them are now known, three of which have been met with in the British islands, one as an occasional visitant, in large flocks, and the other two as extremely rare and accidental stragglers. They are very interesting birds, having one of the most singularly constructed bills to be found in the whole feathered creation, and which, though considered by some as a deformity, is in reality one of the most beautiful contrivances, one of the most admirable adaptations of means to end which occur in the whole

range of animated nature. For a more definite account however, of these birds, we must refer to the article LOXIA.

Next follow the siskins and goldfinches, and then the canaries, all of which, however, having been already described in the article CARDUELIS, we proceed at once now to the different

LINNETS (*Linaria*). The form and plumage of the common linnet are too well known to require a description. It is one of the commonest of British birds, everywhere frequenting open heaths and commons, and breeding in the furze and other bushes. In autumn they associate in large flocks, and traverse the more cultivated parts of the country, often alighting by thousands where the plough has been at work, in search of the many seeds of various wild plants which are everywhere scattered and distributed; they are sometimes observed in company with other species of *Fringillidæ*, but more commonly in flocks, composed entirely of their own species. They are cheerful and lively birds, and very sweet and pleasing songsters, the most musical indeed of all our finches, excepting, perhaps, the goldfinch, though this is matter of opinion. Great numbers of them are annually captured by the bird-catchers, who take them with clap-nets and call-birds, by which means they are very readily decoyed and made prisoners.



Linnet.

The nest is generally constructed in a furze bush, and is formed of moss and stalks of grass neatly interwoven with wool, and lined with feathers and hair. The eggs are four or five in number, of a bluish white, speckled with purplish red colour. They feed on most of the smaller seeds which come in their way, as those of the flax, hemp, dandelion, thistle, &c., and particularly on those of the cruciform plants; and they eat also the leaves of groundsel, chickweed, and some others.

They are strictly granivorous birds, at no period of their existence subsisting upon insect food, nor will they touch it in captivity if offered to them. Even the young are entirely reared upon macerated vegetable diet ejected from the craws of the old birds, and the same obtains in the sub-genera *Carduelis*, *Coccothraustes*, and *Canaria*; though in the chaffinch, sparrow, and bunting tribes, the young are brought up wholly upon insects; and even the adult birds of these latter divisions will feed on insects whenever they have the opportunity. Authors (in many instances mere compilers one from another), have made strange confusion in describing the common linnet, having confounded the summer plumage of this bird with the

greater redpole; another, and a very differently formed species, and which is apparently unknown to almost every British ornithologist.

The SERIN (*Fringilla-serinus Europæus*) is a curious little finch, a native of the central parts of Europe, and remarkable for its small and very short bill. It is of a beautiful yellow, variegated a little with a darker colour. In winter they are found much about gardens upon the fruit trees, but never along the streams and rivulets like the redpole and siskin. It is a pleasing and most indefatigable songster, its notes being low but very melodious, and somewhat resembling those of the skylark, intermixed with a little of the canary. According to Bechstein, "they sing incessantly, either perched on the outer branches of a tree, or whilst rising in the air, and gently sinking again to the former situation, or whilst flying from tree to tree. Their call resembles that of the canary, and their habits are mostly similar to that species. They feed on all the small seeds found in fields and orchards, particularly groundsel, plantain, garden pimpernel, and others of the same kind. In woods they seem attached to beech and oak-trees.

"The nest," according to the same author, "is generally placed on the lower branches of apple and pear trees, sometimes on beeches and oaks, but never on willows by the water side. It is constructed of fine and divided roots, mosses, lichens, principally of those which are farinaceous, the whole being entwined with great nicety, and lined with a thick bed of feathers, horse-hair, and pig's bristles. They generally lay three or four, rarely five eggs, which are white with spots of bright reddish-brown, which form a zone towards the large end. The hen sits thirteen or fourteen days, during which time the male feeds her. He also helps to feed the young ones, which is done by disgorging the food; the young closely resemble those of the common linnet, and may be reared easily upon soaked rape-seed. They remain grey till after moulting, when they attain their full plumage, but are never so beautiful in the house as in the wild state. After being kept a few years in the cage, the yellow on those taken full grown becomes pale, and fades at length to nearly white. This bird will pair with the canary, siskin, linnet, or goldfinch." It is not found in Britain.

The most typical of all the finches are, perhaps, the grosbeaks (sub-genus *Coccothraustes*), in which the bill is conical, very thick, bulging at the base, and rapidly tapering to a point; each mandible being nearly of equal thickness. The wings, in the more typical species, have the tertiary feathers singularly widened at the tips, and abruptly ending, looking as if their extreme ends had been cut off. They are some of the largest of the *Fringillidæ*, and by the power of their massive horny bill, the larger species are enabled to break the shells of the harder kind of seeds and berries, upon which they principally subsist. Their colours are soft, handsome, and well contrasted, without having any tendency to be gaudy, and altogether they form a very well defined group.

The green grosbeak (*C. chloris*) is a very common bird throughout the greater part of Europe, and is everywhere abundant in the British islands, frequenting hedges and the outskirts of woods. It is of the size of, or rather larger than a sparrow, all over of a dull olive green, brightest upon the rump, throat, and belly, which incline to yellow, and having the outer webs of the primary wing feathers bright yellow; the

wing coverts and tertiaries are in winter broadly margined with ash colour, which gradually wears off towards the breeding season, at which time the green upon the back, and indeed the whole plumage, becomes very much brighter, the terminations of each feather being shed. The female has the green and yellow not so bright, and is altogether of a much browner tint than the male: the young are longitudinally streaked in the manner of the linnet.

This bird is by no means typical of the division of the *Fringillidæ* to which it appertains, being intermediate between the more standard grosbeaks and the linnets and canaries; and is indeed commonly known in many parts of the country by the name *green linnet*. It is also called *greenbird* and *greenfinch*. It is rather a familiar species than otherwise, coming much into gardens, and is seldom found but in the neighbourhood of cultivated ground. Their song is very simple, but subdued and pleasing, perhaps more so from its association, and consists of two or three soft trills, with now and then a very singular note, which may be expressed by *te-e-e-a-a-ar*, pronounced slowly and clearly. In the breeding season this bird often sings on the wing, rising from a tree to a little height in the air, and then fluttering to the next tree in a very curious shuffling manner, as if wounded. The nest is placed generally in some thick hedge, and is composed of moss and wool interwoven with a lining of feathers and hair, and considerably resembles that of the common linnet, but is larger and looser; the eggs are also much like those of a linnet, but are rather larger, bluish-white, speckled (chiefly at the large end), with reddish-brown; about four or five in number, the usual complement in this family.

After breeding, and undergoing the autumnal moult, the green grosbeaks assemble in considerable flocks, which become very numerous about the commencement of severe weather; and they commonly associate with chaffinches and yellow buntings, and sometimes bramblingfinches. They subsist upon all sorts of seeds, and very much upon grain, which latter is never touched by any of the birds we have been hitherto de-

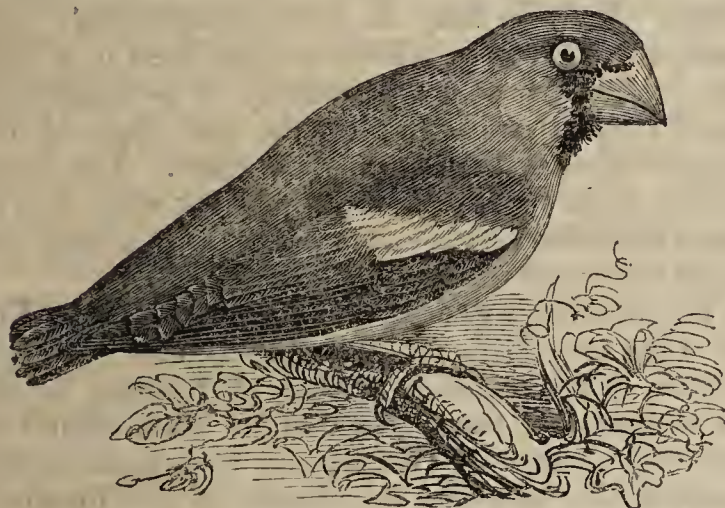


Common Bunting.

scribing; and they appear to feed more upon the green leaves of groundsel and other plants, than any other of our finches. In confinement, when taken young, it becomes remarkably tame; and is often suffered to

fly loose with impunity ; it learns the songs of other birds with facility, and has been known to repeat the canary's song very tolerably ; one taken old, in the possession of the writer, which has been kept for two or three years in the same cage with several other granivorous birds, now imitates very accurately the notes of a bullfinch, or of his companions. This species breeds readily with the canary.

HAW GROSBEAK (*Coccothraustes vulgaris*) is the largest, and one of the most beautiful of the European finches. Its length is about seven inches, of which the tail measures two inches and a third. The bill which is extremely powerful, is like a large blunt cone, very thick in proportion to the size of the body, of a dark bluish colour in summer, in both sexes, and pinkish white, or flesh colour, with the tip blackish, in winter. The forehead, in the male, is yellowish brown ; cheeks and crown of the head, light chestnut ; beneath the chin, black, forming a large square spot ; nape of the neck, a delicate ash grey ; back dark rich brown, shaded with grey upon the rump : tail-coverts, light chestnut ; under parts of the body dirty red, shading into whitish about the vent ; the lesser wing-coverts are black, the greater brown behind and whitish before, which forms a pale streak across the wings ; quills black, tipped with steel-blue, their inner webs having a long white spot, secondaries steel-blue, and terminated with angles so obtuse as to appear as if the tips had been cut off ; tail black, the tips of the two centre feathers shaded with grey, and all the exterior ones are white at the extremity of the inner web.



Haw Grosbeak.

All over the plumage of this bird is very soft and silky in its nature, more so than in any other of our *Fringillidæ*, not excepting even the goldfinch ; and it undergoes no seasonal change, as is the case with all the others, being equally bright in winter and summer, and the edges of the feathers being permanent.

The female has the general tints of the plumage rather duller than the cock bird, and the cheeks, head, and upper tail-coverts are of a greyish chestnut colour. The young, in their nestling plumage, differ from adults considerably, the head and throat having a strong yellowish tinge ; there is another bar of whitish across the wing, formed by the lesser coverts, being also tinged with brownish white ; the rump is of a brownish cream colour ; from each corner of the mouth proceeds downwards a row of small black feathers, which just trace the outline of what in the old bird is a large black spot ; and the flanks are thickly dotted with transverse oval brown spots, very similar to those upon the breast of a hen missel-thrush ; quill and tail-feathers the same as other adults.

The haw grosbeak is rare in the British islands, and in summer is one of the very shyest birds we have, which has occasioned several writers to speak of it as a winter visitant, though at the same time they were aware of its breeding abundantly in some parts of France ; so that, contrary to all analogy or probability, they described it to migrate northward to spend the winter. It is properly a bird of the woods, and even forests, but so very shy, that in some parts of Kent and Surrey, where it is far from being very uncommon, it is extremely difficult to get even a distant view of it, and specimens in summer plumage are only to be obtained by very tedious and patient watching. It is entirely a vegetable feeder, subsisting chiefly on the various produce of different trees, as the kernels and seeds of the beech, elm, ash, and maple ; and in winter of the berries, or rather the seeds and stones, of the juniper, service tree, and whitethorn ; it attacks also cherries and plums, the stones of which, by means of its powerful beak, it breaks with the greatest ease, to feed upon the enclosed kernels. The writer has known, also, a brood of young ones to feed very largely upon green peas. A wounded old one, which he kept for some time in confinement, rejected almost everything but hempseed, and invariably refused to feed on haws, the berries from which the species has been named, which seems to indicate that they only resort to those in times of necessity. This bird will become extremely familiar in confinement, though it is necessary to guard oneself from its powerful beak, with which it can inflict a very severe bite.

The song of the haw grosbeak is very simple and inward, with but little melody to attract our notice ; it consists of a low whistling, intermixed with some harsh tones, and is audible only at a short distance. The nest is well built, but shallow, formed of sticks and lichens, and lined with fibres of roots and other soft materials. This is placed usually on the upper branches of small trees, and often in the thick top of a pine or other evergreen. The eggs are from three to five, greenish grey, spotted with brown, with a few streaks of blackish at the larger end. We knew an instance of one of these nests being taken in the fork of a tree, near Richmond Park, Surrey ; and another being placed the following year in the same identical situation. The species is not rare in that neighbourhood, but upon entering a coppice, the very first bird to take the alarm and flee away is generally the haw grosbeak. The only chance of shooting one in summer is the instant they take their flight from a tree, for they are not to be discovered amid the thick foliage. In winter they congregate in small flocks, and frequent the hedges in bad weather, losing much of their usual wariness.

There is a species closely allied to the haw grosbeak which inhabits the Indian islands, and another, a very beautiful one, with black and bright yellow plumage, termed *C. icterina*, in the Himalaya. North America also possesses one species, and a very characteristic *coccothraustes*, which is described by the continuator of Wilson's Ornithology under the name of

EVENING GROSBEAK (*C. vespertina*). It is a beautiful bird, about eight and a half inches long ; bill greenish yellow ; forehead bright yellow, prolonged in a broad stripe over the eyes ; head black, shading, as it descends, to olive-brown ; back, rump, and under parts, yellow, brightest upon the rump,

and tinged with olive brown upon the belly; quill and tail feathers black, the two exterior of the latter having a large oval black spot; lesser secondary feathers pure white.

This bird appears to have an extensive range over the more northern and north-western parts of America. By day they are described "to retire into deep swamps, which are covered with a thick growth of various trees of the coniferous order, and only leave them in small parties at the approach of night. Their note is strange and peculiar, and it is only in twilight that they are heard crying in a singular strain. This mournful sound, uttered at such an unusual hour, strikes the traveller's ear, but the bird itself is seldom seen; though, probably, from its unacquaintance with man, it is so remarkably tame and fearless, as almost to suffer itself to be caught with the hand*." The sexes are very much alike.

CARDINALS (*Guiracæ*). The other American birds allied to the grosbeaks pertain to a separate division, which is peculiar to the new world, and intermediate between *Coccothraustes* and the bullfinches. In these, the bill is higher than broad, the upper mandible being larger than the lower, and covering its margins entirely, as in the bullfinches; its form is not so completely angular, but is very slightly curved. Red is the predominating colour of the plumage, which in its texture resembles more that of the true bullfinches; and the wings are generally short, and the tail rather long than otherwise. The type of this division is the

RED CARDINAL (*G. Cardinalis*), Cardinal Grosbeak, or Virginian Nightingale, as it is sometimes called; a bird, of which caged specimens are often imported into this country, and sold at a high price. This species is eight inches in total length, and eleven in extent of wing; all the upper parts dull dusky red, the crest (which is long, pointed, and erectible), and the whole under parts, bright vermilion; front, cere, and throat, black; tail extending three inches beyond the points of the wings; bill thick and powerful, and of a bright coral hue; legs and feet pale hazel. The female has the crest shorter, and raises it less frequently, and is also of smaller size than the male; all the upper parts are brownish olive, the tail, wings, and tip of the crest excepted, which are nearly as red as in the male; breast and lower parts reddish drab.

"The beautiful song of this species," observes Bechstein, "is so like that of the nightingale, that the name of *Virginia Nightingale* has been given to it; but its voice is so strong, that it pierces the ear. It sings through the whole year, except at the time of moulting." They have only, however, a few of the more powerful and shaking, or thrilling notes, of that bird, at least, to judge by those we have heard singing in cages. Wilson says, "to this name, as Dr. Latham observes, they are fully entitled, from the clearness and variety of their notes, which, both in a wild and domestic state, are very various and musical: many of them resemble the high notes of a fife, and are nearly as loud. They are in song from March to September, beginning at the first appearance of dawn, and repeating a favourite stanza or passage twenty or thirty times successively; sometimes, with little intermission, for a whole morning together, which, like a good story too often repeated,

becomes at length tiresome and insipid. But the sprightly figure and gaudy plumage of the red bird," (as he is commonly called in the United States), "his vivacity, strength of voice, and actual variety of note, and the little expense with which he is kept, will always make him a favourite.

"This species, like the mocking-bird, is more numerous to the east of the great range of the Alleghany Mountains, and inhabits from New England to Carthagenæ. Michaux the younger, son to the celebrated botanist, informed me, that he found this bird numerous at the Bermudas. In Pennsylvania and the northern states, it is rather a scarce species; but through the whole lower parts of the southern states, in the neighbourhood of settlements, I found them much more numerous; their clear and lively notes, in the months of January and February, being, at that time, almost the only music of the season. Along the road sides and fences I found them hovering in half dozens together, associated with snow birds, and various kinds of sparrows. In the northern states they are migratory; but in the lower parts of Pennsylvania they reside during the whole year, frequenting the borders of creeks and rivulets, covered with holly, laurel, and other evergreens. They love also to reside in the vicinity of fields of Indian corn, a grain that constitutes their chief and favourite food. The seeds of apples, cherries, and of many other sorts of fruit, are also eaten by them: and they are accused of destroying bees.

"In the months of March and April, the males have many violent engagements for their favourite females. Early in May, in Pennsylvania, they begin to prepare their nest, which is often fixed in a holly, cedar, or laurel bush. Outwardly, it is constructed of small twigs, tops of dry weeds, and slips of vine bark, and lined with stalks of fine grass. The female lays four eggs, thickly marked all over with touches of brownish olive, on a dull white ground; and they usually raise two broods in a season.

"The opinion which so generally prevails in England, that the music of the groves and woods of America is far superior to that of Europe, I, who have a thousand times listened to both, cannot but admit to be correct. We cannot with fairness draw a comparison between the depth of the forests in America, and the cultivated fields of England; because it is a well known fact, that singing birds seldom frequent the former in any country. But let the latter places be compared with the like situations in the United States, and the superiority of song, I am fully persuaded, would justly belong to the western continent. The few of our song-birds that have visited England, extort admiration from the best judges. 'The notes of the cardinal grosbeak,' says Latham, 'are almost equal to those of the nightingale. Yet these notes, clear and excellent as they are, are far inferior to those of the wood thrush, or even to those of the brown thrush, or thrasher (*Orpheus rufus*).' Our inimitable mocking bird is also acknowledged by themselves, to be fully equal to the song of the nightingale, in its whole compass. Yet these are not one-tenth of the number of our singing birds. Could these people be transported to the borders of our woods and settlements in the month of May, about half an hour before sunrise, such a ravishing concert would greet their ear as they have no conception of."

Europeans are now perfectly willing to concede

* C. L. Bonaparte.

that America produces several very fine song birds, and some which are, perhaps, fully equal to the best of any other country; yet still there is some reason to consider that the above picture is a little overdrawn. Certain it is, that persons from this continent are, in general, much disappointed with the music of the American groves, at least when they expect to find it surpass, or even approach to that which enlivens the woodlands and the fields of Europe. Even the mocking bird, unquestionably the prince of American songsters (as we have heard a sufficiently competent judge in these matters declare), though his own native notes would raise him to the very foremost rank of feathered musicians in any country, for the most part amuses rather by the correctness of his imitations of various discordant sounds, than charms the ear by the harmonious melody of his voice. Wilson himself never heard the nightingale of Europe, nor, from the descriptions he had read of it, was he aware that it sings much more by day than in the night; and he, therefore, institutes a comparison, and contrasts forcibly the music of the mocking bird, which is heard above every other in open day, with the voice of the European Philomel, of which even the bard of Avon says (and Wilson quotes the passage), that

“—if she could sing by day
When every goose is cackling, would be thought
No better a musician than the wren.”—

But Shakspeare himself here sacrifices minute accuracy for poetic effect, as all who have lived in neighbourhoods where nightingales pass the summer must be well aware of. Those who are familiar with the European bird, will at once fully recognise the force of the following passage, quoted from Wilson's description of the American mocking bird, and applied to the nightingale of this continent.—“In his native groves, mounted on the top of a tall bush, or half-grown tree, in the dawn of dewy morning, while the woods are already vocal with a multitude of warblers, his admirable song rises pre-eminent over every competitor. The ear can listen to *his* music alone, to which that of all the others is a mere accompaniment.” But we are now wandering much from the proper subjects of this present article, and the merits of the so-called Virginia nightingales have, by degrees, led us to consider those of the “leader of the vernal song” in Europe.

“The males of the cardinal grosbeak,” continues Wilson, “when confined together in a cage, fight violently. On placing a looking-glass before the cage, the gesticulations of the tenant are truly laughable; yet with this he soon becomes so well acquainted, that, in a short time, he takes no notice whatever of it; a pretty good proof that he has discovered the true cause of the appearance to proceed from himself. They are hardy birds, easily kept, sing six or eight months in the year, and are most lively in wet weather. They are generally known by the names, red bird, Virginia red bird, Virginia nightingale, and crested red bird, to distinguish them from another beautiful species, the red pyrange (*Pyrranga rubra*), one of the *Tanagrini*æ.

“One peculiarity in the female of this species is, that she often sings nearly as well as the male. I do not know whether it be owing to some little jealousy on this score or not, that the male, when both occupy the same cage, very often destroys the female.” Upon the whole, there are several traits here recorded of the red cardinal, which certainly accord very strik-

ingly with the European bullfinch. Their food is the same, each subsisting much on the seeds of various berries, and the plumage of both is of the same peculiar soft texture, unlike that of most other *Fringillidæ*. The female bullfinch sings quite as well as the male, and as to quarrelsomeness in confinement, we have known a female bullfinch to attack and destroy another which was placed for a few minutes only in its cage.

ROSE-BREASTED CARDINAL (*G. rosea*), by some writers styled *G. Ludoviciana*, although so far from being common in Louisiana, as the latter name would imply, neither Wilson nor his continuator, C. L. Bonaparte, were able to furnish any instance of its occurring in that territory. Not but that it may occasionally be found there, as the common waxwing sometimes straggles into Bohemia, but it certainly has no more claim to the specific title *Ludoviciana*, than the waxwing has to its common designation of *Bohemian*. If names are to have any meaning at all, surely they are not to convey erroneous impressions; and it is time, now that all such misleading appellations were expunged from our catalogues of objects of natural history, or, at least, that they were retailed only as synonymous till more appropriate designations had come into general use. The rose cardinal appears to be a more northern species than the last, but in winter has been observed in Mexico. Wilson says, “this elegant species is rarely found in the lower parts of Pennsylvania, in the state of New York, and those of New England; it is more frequently observed, particularly in fall, when the berries of the same year are ripe, on the kernels of which it eagerly feeds.—Some of its trivial names would import that it is also an inhabitant of Louisiana, but I have not heard of its being seen in any of the southern states. A gentleman of Middleton, Connecticut, informs me, that he kept one of these birds for some considerable time in a cage, and observed that it frequently sang at night, and all night; that its notes were extremely clear and mellow, and the sweetest of any bird with which he was acquainted.”

“Its recent discovery in Mexico,” observes Bonaparte, “is an interesting fact, and we may safely conclude that this bird migrates extensively according to season, spending the summer in the north, or in the mountains, and breeding there, and in winter retiring southward, or descending into the plains; being, however, by no means common in any known district, or at any season, though, perhaps, more frequent on the borders of Lake Ontario. Its favourite abode is large forests, where it affects the densest and most gloomy retreats. The nest is placed among the thick foliage of trees, and is constructed of twigs outside, and lined with fine grasses within; the female lays four or five white eggs, spotted with brown. This may also be called an ‘evening grosbeak,’ for it sings during the solemn stillness of night, uttering a clear, mellow, and harmonious note.”

This species is eight inches and a half long, and thirteen in extent. The whole upper parts are black, with the exception of the white stripes across the wing; neck, throat, and upper part of the breast, black; lower part of the breast, middle of the belly, and lining of the wings, of a fine lively carmine or rose colour; tail forked, black, with the three outer feathers white at the tips of their inner vanes; bill pure white; legs and feet light blue. These colours are not fully acquired until the second year. The female is rather smaller, with the bill horn colour, instead of white;

the upper parts are of an olive brown, spotted with a darker colour; lines over and under the eye, and all the under parts whitish, with a dark spot along the centre of each feather; tail brown, and not so broadly marked with white. The male, in his first plumage, much resembles the adult female.

The BLUE CARDINAL (*G. cærulea*), is another species mentioned in Wilson's work. All the upper parts are of a rich purplish blue, but duller on the back, where it is streaked with a dusky colour; wings black, marked with chestnut colour and blue; tail black and forked, slightly edged with bluish, and sometimes minutely tipped with white; bill of a dusky bluish horn colour; legs and feet lead colour.

According to Wilson, "this solitary and retired species inhabits the warmer parts of America, from Guiana, and probably farther south to Virginia. Mr. Bartram saw it during a summer's residence near Lancaster, Pennsylvania. In the United States, however, it is a scarce species, and having but few notes is rarely observed. Their most common call is a loud *chuck*; and they have also at times a few low sweet-toned notes. They are sometimes kept in cages in Carolina; but seldom sing in confinement." Of a live individual he received from South Carolina, he observes, "during its stay with me, I fed it on Indian corn, which it seemed to prefer, easily breaking with its powerful bill the hardest grain. They also feed on hempseed, millet, and the kernels of several kinds of berries. They are timid birds, watchful, silent, and active, and generally neat in their plumage. Having never yet met with the nest, I am unable at present to describe it."

There are several other species of this genus inhabiting South America, though as nothing peculiar has been related of their habits, it will be hardly worth while here to transcribe their names, or to give a detailed account of their markings. They are for the most part birds of gaudy, or at least showy plumage, and shy and retiring in their habits; generally passable songsters, and subsisting chiefly on the seeds enclosed in berries, and the kernels of the smaller stone fruits. One species, however, we may just notice, as as it may often be seen in cages in the London bird shops.

The RED-HEADED CARDINAL (*G. erythrocephala*), or, as it is often called, Paradise Grosbeak, is a Brazilian bird, all over of an ash-colour, except the head (which is adorned with a pointed crest,) and the throat, which are bright crimson. It sings throughout the whole year, but with so weak a voice that the slightest noise overpowers it.

The next group we shall notice are the chaffinches, birds to which the generic name *Fringilla* has by some been more particularly restricted, not, however, as we should say, very judiciously. As a group, the *Fringillidæ* are especially distinguished as seed-eating birds, and many of its forms, as the siskins, linnets, canaries, and true grosbeaks (*Coccothraustes*), are exclusively vegetable feeders, at no period of their existence touching animal food in any shape whatever, even the nestlings being fed entirely with vegetable diet ejected from the craws of the old birds. But this is not the case with the chaffinches, for the adult chaffinch and brambling of this country (the types of the division) subsist much on insects of various kinds, and their young are always brought up wholly upon insects. This is in some degree indicated by their structure; for it will be found,

that those birds which live wholly upon grain require a craw, or considerable dilatation of the gullet, which forms a receptacle in which the food may macerate and soften for some time before it is taken into the stomach; and where this occurs the stomach or gizzard will generally be found smaller and less muscular than in species where the craw is wanting, or comparatively small, as will be observed by comparing the craw and gizzard of a common chaffinch with those of the equally common green grosbeak. In the chaffinch the craw is but very small, and in the brambling it is hardly observable, while the stomachs of both these species are larger than in those birds which live wholly upon grain. The absence of a craw, we believe, in any small bird, indicates the species to be partly, if not wholly insectivorous, and we find nothing of the kind in the *Corvidæ*, or crow family, in the starling family, *Sturnidæ*, or even in the larks, all of which are partly granivorous birds, though subsisting more upon animal food; and the whole of them being arranged by Cuvier, together with the finches, in his *tribe* or *sub-order* *Conirostres*, though they would certainly range much more naturally as a separate and equivalent division, which by some has been indicated by the name *Omnivori*, signifying "birds which will eat all that is eatable." There is, however, a more definite character than the absence of craw, by which these birds might be separated from the fringillidous races; we allude to a peculiarity in the plumification. In all the *Corvidæ*, the *Sturnidæ*, and the larks, the young birds shed their whole plumage at the first moult, including the wing and tail primaries, and a few weeks after quitting the nest; but in the *Fringillidæ*, as in all the true *Dentirostres*, although the first clothing feathers are in most cases changed even more early*, the wing and tail primaries are in no instance that we are aware of shed until the second general autumnal change of plumage, and this holds even in species which, as the pipits and wagtails, moult their clothing-feathers twice in the year, as we can safely assert from repeated and careful observation; so that, curious as it may seem of species which so much resemble as to be popularly (and even scientifically by the older naturalists) arranged together in a single genus, lark, it is nevertheless a certain fact, that, while the true larks (*Alauda*) change their wing and tail primaries almost immediately after leaving the nest, the pipits (or, as they are often called, titlarks) do not shed theirs until the third (including the vernal) time that they change their clothing-feathers. We may observe, also, that there are some species, as the swallow tribes and the bearded reed bird, which appear to change the tail-feathers at the first moult, but not the wing primaries. The latter species is indeed more peculiar in its characters than any other bird we know, and will range naturally with no family whatever. It is also the only bird we know of allied to the *Dentirostres* which exhibits a craw, from which it differs strikingly from all the members of that division. To return, however, to the consideration of this character, although its absence appears invariably to indicate that a species is at least partly insectivorous, its presence does not in all instances prove the reverse;

* In the blackcap, and some other dentirostral birds, the nestling feathers of the breast are changing even before the primaries have attained their full length.

for the sparrows and the buntings, which have large craws, subsist much, and feed their young wholly, upon insects. The true position of the chaffinch genus we consider to be intermediate between the typical finches and the *Spizæ*, or nonpareils, of the American continent.

The shape of the bill is, in the chaffinch genus, conical, longer than deep, straight and pointed, and having the conical edges entire; they are of a longer and more slender form than the grosbeaks, and the bill is less strong and thick, and less swollen at the base, than in those birds. Their habits are also less arboreal, and they obtain their food more upon the ground, where they sometimes hop about, but more generally, when feeding, use a peculiar even walking mode of progression, advancing by quick short steps, as all must have noticed who have observed a common chaffinch feeding on the road. The plumage is, in winter, generally very much fringed with terminal edgings, insomuch that their colours often appear different at different seasons of the year; but, as they increase in age, they have less and less of these edgings at every moult, as is indeed the case with all other birds the feathers of which are thus tipped.

The common chaffinch (*Fringilla cælebs* of Linnæus) is a handsome and a gay and sprightly bird, very abundant in most parts of the British islands, and much too well known to require its plumage being described. It is termed *cælebs*, or the bachelor, from the habit which the females have, in its more northern localities, of migrating in winter a little to the southward, while the males continue about their summer residence all the year. This separation of the sexes is, however, comparatively very partial in the British islands, many female chaffinches remaining throughout the winter, even in the northern parts of Scotland; but it is observed, sometimes, in cold seasons, even in the southern counties of England; and indeed, flocks of hen chaffinches, from the northern parts, may occasionally be seen in the south of England almost every winter, while the majority of resident individuals continue solitary.

The chaffinch has a simple and pleasing song, rendered, however, more so by its associations with early spring, this bird being one of our earliest songsters, and occasionally treating us with a repetition of its short stave, even in autumn. There is no variation in its music, and it consists but of a simple run of notes, reiterated over and over again, till it becomes tiresome. Yet this monotonous stave seems to be admired most unaccountably by our continental neighbours, with whom the chaffinch is one of the commonest and most favourite cage-birds, so much so, that Bechstein, a professed "bird-fancier," devotes no less than seven pages of his work to a dissertation on its song, and five or six more to the mode of capturing it, and manner of treating it in confinement. "To such an extent," he says, "is the passion for this bird carried in Thuringia, and those which sing well are sought for with such avidity, that scarcely a single chaffinch that warbles tolerably can be found in the province. As soon as one arrives from a neighbouring county, whose notes appear good, all the bird-catchers are after it, and do not give up the pursuit till they have secured the prize."

"This bird," he observes, "is so great a favourite in Germany, that not a single tone of its voice has escaped the experienced ears of our bird-fanciers. They have observed its nicest shades, and are con-

tinually endeavouring to improve and perfect it. I confess I am myself one of its warmest admirers. I have constantly around me the best songsters of the species, and, if I liked, could write a good-sized volume on all the details of its music," &c. And he does distinguish, by separate names, as many as eight variations, or simple modifications of its lay.

"In Ruhl," he relates, "a large manufacturing village in Thuringia, the inhabitants, mostly cutlers have such a passion for chaffinches, that some have gone ninety miles from home to take, with bird-lime, one of these birds, distinguished by its song, and have given one of their cows for a fine songster; from which has arisen a common expression among them, that such a chaffinch is worth a cow. A common workman will give a *louis d'or* (sixteen shillings) for a chaffinch he admires, and willingly live on bread and water to gain the money." In England there are very few indeed who think the chaffinch worth keeping in a cage.

This species builds a remarkably beautiful nest, placing it in various situations upon the trees and bushes, sometimes amid the ivy, encircling their trunks, at other times in the forks of smaller branches, and very frequently in old apple-trees, overgrown with lichens and moss. It is formed of different mosses and lichens, closely interwoven with wool, and warmly lined with feathers and hair, in its outward appearance always accordant with the particular situation. The eggs are four or five in number, of a bluish white, tinged more or less with pink, and marked with streaks and spots of purplish red. It is widely dispersed, and found in all parts of Europe.

THE MOUNTAIN CHAFFINCH (*F. montifringilla* of Linnæus) we have already described under the name of BRAMBLE-FINCH. There are other species inhabiting Asia, but perfectly similar, we believe, in their habits to the common chaffinch. Closely allied to them are the different snow finches, which are still less arboreal in habit, and have smaller bills; their colours also are more uniform and less brilliant.

THE ALPINE SNOW-FINCH (*F. nivalis* of Linnæus) is a species very common upon the Alps and Pyrenees, with plumage chiefly ash colour above, and whitish beneath, mottled with black and white; the bill is of a glossy black. This bird and another allied to our common hedgechanter, the *Accentor alpinus*, inhabits higher up the European mountains than any other. It is found in winter as far north as the middle of Germany, where it associates often with the mountain chaffinch, but is even more insectivorous than that species. It sings a great deal, though there is nothing in the quality of its song to recommend it to particular notice. According to Temminck it builds its nest upon the rocks, or in their chinks and crevices, and lays about five eggs of a pale green, with faint lines and spots of ash colour, intermixed with a few spots of dark green. Its food consists of the seeds of the pine and larch, together with various kinds of insects.

THE AMERICAN SNOW-FINCH (*F. hyemales*) came under the observation of the talented ornithologist, Wilson, and accordingly we are furnished by him with a detailed and graphic description of its peculiar manners. "Small and insignificant," he observes, "as this well known species is, it is by far the most numerous, as well as the most extensively disseminated, of all the feathered tribes that visit us from the frozen regions of the north, their migration extending from

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the arctic circle, and probably beyond it, to the shores of the Gulf of Mexico, spreading over the whole breadth of the United States, from the Atlantic ocean to Louisiana; how much farther westward I am unable to say. About the 20th of October they make their first appearance in those parts of Pennsylvania east of the Alleghany mountains. At first they are most generally seen on the borders of woods, among the falling and decayed leaves, in loose flocks of thirty or forty together, always taking to the trees when disturbed. As the weather sets in colder, they approach nearer the farm-house and villages; and on the appearance of what is usually called falling weather, assemble in larger flocks, and seem doubly diligent in searching for food. This increased activity is generally a sure prognostic of a storm. When deep snows cover the ground they become almost half domesticated. They collect about the barn, stable, and other out-houses, spread over the yard, and even round the steps of the door, not only in the country and villages, but in the heart of our large cities, crowding around the threshold early in the morning, gleaning up the crumbs, appearing very lively and familiar. They have also recourse at this severe season, when the face of the earth is shut up from them, to the seeds of many kinds of weed that still rise above the snow, in corners of fields, and low sheltered situations, along the borders of creeks and fences, where they associate with several species of sparrows. They are at this time easily caught with almost any kind of trap; are generally fat, and, it is said, excellent eating.

"I cannot but consider this bird as the most numerous of its tribe of any within the United States. From the northern parts of the district of Maine, to the Ogeechee river in Georgia, a distance, by the circuitous route in which I travelled, of more than 1800 miles, I never passed a day, and scarcely a mile, without seeing numbers of these birds, and frequently large flocks of many thousands. Other travellers with whom I conversed, who had come from Lexington, in Kentucky, through Virginia, also declared that they found those birds numerous along the whole road. It should be observed, that the road sides are their favourite haunts, where many rank weeds that grow along the fences furnish them with food, and the road with gravel. In the vicinity of places where they were most numerous, I observed the American kestrel (*Tinnunculus sparverius*), and several others of his tribe, watching their opportunity, or hovering cautiously around, making an occasional sweep among them, and retiring to the bare branches of some old cypress, to feed on their victim. In the month of April, when the weather begins to be warm, they are observed to retreat to the woods, and to prefer the shaded sides of hills and thickets; at which time the males warble out a few very low sweet notes, and are almost perpetually pursuing and fighting with each other. About the 20th of April, they take their leave of our humble regions, and retire to the north, and to the ranges of the Alleghany, to build their nests, and rear their young. In some of these ranges, in the interior of Virginia, and northward about the west branches of the Susquehanna, they breed in great numbers. The nest is fixed on the ground, or among the grass, sometimes several being within a small distance of each other. According to the observations of the gentlemen connected with the Hudson's Bay factory, they arrive there

about the beginning of June, stay a week or two, and proceed farther north to breed. They return to that settlement in the autumn, on their way to the south."

The above very interesting account supplies us with a tolerably precise and definite knowledge of the snow-finches, as a group, and what little we have been able to collect concerning the European species accords exactly with it. They are inhabitants of colder situations, and live more upon the ground than the true chaffinch, and do not, like them, nidificate in trees and bushes; they serve to connect the chaff-finches with some of the genera allied to the sparrows, between which and them there is a gradual concatenation of intermediate forms, from the consideration of which we might proceed, by an unbroken series, to the buntings and snowflakes, and thence to many other *Fringillidæ*. The members of this family are indeed so numerous, that it would be a hopeless endeavour to describe them all, and they are so generally similar in their economy, differing only in minor characters, which are important only in furnishing means by which they may be naturally arranged, that the describing many more of the species would become a very tedious repetition, if it has not been so in some degree already. An account of the sparrow races will be found in the article entitled *PASSER*, and the bunting tribes are described under *EMBERIZA*.

There are, however, a great many tropical species, many of which are adorned with gaudy plumage, and which are imported in considerable numbers into this country; and, though we are altogether strangers to the habits of most of them in a state of nature, it may be as well, before we conclude the article *FRINGILLIDÆ*, just to mention a few of the more conspicuous of them, at least of those which are commonly exposed for sale at the London bird shops.

The Whidah birds, (genus *Vidua* of some naturalists) are an African group, the males of which are remarkable for an astonishing development of plumage in the breeding season. In winter they resemble the other sex, and are not very unlike a common linnet; but they moult their plumage twice in the year, and the following is a description of the adult male of the commonest species, *V. paradisæa*, in his summer garb.



Whidah Finch.

The bill (which is intermediate in character between those of the finches and buntings) is of a lead colour; irides chestnut; the head, chin, front of the neck, back, wings, and tail, glossy black; back of the neck pale orange; breast, thighs, and upper part of the belly white, the lower part black; the two middle tail-feathers

measure fourteen inches, are very broad, and terminate in a long filament; the two that follow are also very broad in the middle, but narrower and more pointed at the end, and also end in a similar long filament; the other side feathers are much shorter, but the two next to those which are elongated are a little diverging, and arch over like the tail of a cock, are glossy, and more brilliant than the others.

This beautiful species, according to Bechstein, comes from Angola, and other parts of Africa, and is particularly common in the kingdom of Whidah, in Guinea, whence it has derived its name. They are lively birds, constantly in motion, always waving their long tails up and down, and often arranging their feathers, and they are very partial to bathing. They are healthy birds in confinement, and require to be kept in a large cage, that their handsome tail should not be injured. They sing a little, and their notes though somewhat melancholy are very agreeable.

THE DOMINICAN WHIDAH (*V. serena*) is a smaller species than the last, rarer, and with a still longer tail. It is sold in London at a very high price, and sings as agreeably as the other. A third species, the shaft-tailed Whidah (*V. regia*) has a tail rather shorter, but is equally beautiful, and is not less admired than the two former.

THE AMANDUVAD (*Fringilla amandeva* of Linnæus) is a beautiful little finch, which is brought to Europe in great numbers by the vessels trading with India. It inhabits Bengal, Java, Malacca, and other countries of tropical Asia, and also Africa, is about four inches long, of which the tail measures one and a third; its bill is short and thick, and of a deep bright red; irides also red; the males are several years before their colours become fixed, and the plumage attains its utmost stage of beauty; the head and under part of the body are then of a fiery red, the upper part of a dark grey, but the feathers having a broad red edge, the latter colour seems to prevail; in the same way the rump appears to be of a brilliant orange, though the extreme tips only of the feathers are of that colour all over; many of the feathers are also terminated with shining white spots, which are largest upon the wings, and which impart a remarkably pretty appearance to the bird. The females are smaller, and not so bright, and from the time the species takes to arrive at its full beauty, it is rarely that in a large cage-full of them one can find two that are exactly alike.

They are remarkably social little birds, and sing very sweetly, their run of notes resembling exceedingly those of our pleasing vernal songster, the willow wren (*Sylvia trochilus*); and what is singular, however many may be confined together in the same cage (and in the London shops we may often see thirty or forty), they never sing together, but in turns, the rest keeping quite silent to listen to the little songster. They are very active, often bowing and spreading their tails like a fan, are fed upon canary seeds, and millet, and will live from six to ten years in confinement.

THE WAXBILL (*Loxia astrilda* of Linnæus) is allied to the last, but has a smaller bill, and exhibits a considerable degree of affinity with the bearded reed bird. It is a little larger than the gold crested regulus, its length being but four inches and a half, of which the tail feathers measure two; the bill is dark red; a band which crosses the eyes, together with the centre of the breast and belly, are red; the remainder of the lower parts are grey and the upper

brown, being everywhere streaked with soft transverse hairs, which become finer as they approach the head; tail pheasant shaped. The waxbill inhabits the Canary islands, Senegal, Angola, the Cape of Good Hope, and may be found even as far as India, whence they are brought in considerable numbers to Europe; they are much admired for their gentle and tame disposition, soft plumage, and elegant shape, and are generally kept, like the amanduvads, about a dozen together in one cage. They are fed on millet, which forms their chief subsistence in their native country, to the damage of the fields which are sown with it. They are said to approach the villages as familiarly as our sparrows, and are readily caught in traps. Their song is hardly worthy of notice.

The wild habits of the tropical *Fringillida* are in general but very little known, and they require to be studied, with a view to the generic classification of the birds, which as yet has hardly been attempted, nor can it be accomplished satisfactorily from a mere examination of their stuffed skins. It will probably, however, be a long time yet before we understand much of the peculiar economy of these interesting and beautifully plumaged tribes.

FRITILLARY is the *Fritillaria imperialis* of Linnæus, a large genus of bulbous flowering plants, chiefly introduced into our flower gardens from Persia and the warmer parts of Europe. They belong to *Tulipaceæ*.

FROG (*Rana*), a genus of *Batrachian* reptiles, the typical genus, and the one from which the name is taken, *Batrachos* being the Greek name for a frog. In the Linnæan system, the genus *Rana* included not only the frogs properly so called, but the *tree frogs* (*Hyla*), and the *toads* (*Bufo*); and Cuvier, as he has done in many other instances, has retained the Linnæan arrangement for the whole genus, or rather family, but has divided it into three sub-genera, answering to those which we have mentioned; agreeably to that arrangement, we shall notice the three, each separately under the common English name, and thus the present article will be restricted to a very short account of the true frogs.

The general physiology and relations to the other parts of the animal kingdom will be found treated at some length in the article BATRACHIA, so that it will not be necessary to repeat them here, but merely to give some general hints and short notices of the leading species, the whole number of which is too extensive for the space to which we are restricted, and some of the species are so little known, that nothing very interesting to common readers can be said concerning them.

The general characters of frogs are:—The body thick, and a little compressed, elongated, moist on the surface, covered on the upper part with a few small tubercles, and generally granulated on the under surface, with the exception of that of the thorax which is smooth. On each side of the back, just above the loins, some of the species have an angular fold. The fore feet have four separate toes, or toes without any webs, the thumb being larger than the others, and in the males undergoing a peculiar enlargement at the pairing time. The hind feet are much longer, not much less than the length of the body; and they are five-toed and palmated in all the species. The upper jaw is furnished with a single row of small and finely pointed teeth, and there is also a row of similar teeth across the palate. The tongue is short, thick, and

fleshy, adhering to the sides of the under jaw, but capable of being elevated against the palate, so as completely to close the communication with the nostrils. It will be perceived that this structure of mouth is a simple swallowing one; and that a frog can neither bite nor masticate. This points immediately to the kind of food on which it must subsist, namely, food which it can take into the stomach without any preparation; and in the taking of this food, frogs are of considerable service to man on the land, and not altogether useless in the water. The different species of slugs, which are so very destructive in gardens, and to many culinary and other useful plants, form one principal article of the food of frogs; and, therefore, frogs are deserving of much encouragement, in consequence of the value of their labours; and, while their labours are thus valuable, they themselves harm nothing. They do not burrow in the earth, neither do they eat any vegetable substance so far as is known; and, therefore, while they tend to preserve vegetation in the moist places of the garden, and indeed in all places of it on those damp and dewy nights in which slugs are so mischievous, they are always worth protecting; and not only so, but it is worth while to keep a little pond for their aquatic amusements, nor, perhaps, is it altogether amiss to have a bit of stagnant water in some waste place, in which they may breed; for, though the nuptial songs of the frogs are not the most melodious in the world, there is an association of cheerfulness with their croaking—their song, such as it is, is a song of hope; it tells us that the season of growth and beauty is coming, and in the case of the common frog, it tells this very early in the season.

There is another reason why some attention should be paid to frogs, and that is their value as an article of food. Both the common frog and the green frog, which is specially called the esculent one, are fit for this purpose; and, though there is a prejudice against them in Britain, it is an exceedingly ill-grounded and foolish one. It is even worse than this, because it is a remnant of that ancient political animosity which existed so long between England and France; and which, unfortunately for both nations, kept the nearest and most powerful neighbours, whose best interest it was to be at peace, as they could mutually serve each other at the least expense, in a state of constant war, or, at all events, in a panic of mind always prepared for battle. This part of the prejudice is nearly exploded; and it would be just as well to explode the other part; and as we do not now hate Frenchmen, so neither should we loathe frogs. The hind legs and thighs of the frogs are the only parts which are eaten; because they are the only parts which contain much muscle; and this muscle is firm, white, well-flavoured, and exceedingly nourishing. This is, in fact, the case with the muscle of all esculent reptiles, and it arises from the quantity of gelatine, of a very pure description, which exists in all the parts of them.

Frogs have no trace of ribs in their skeletons; the sternum is formed at the under part of a cartilaginous appendage, and it terminates in a disc under the larynx which is united to the clavicles, while a disc at the other extremity, immediately in front of the belly, is attached to the abdominal muscles only.—The bones of the skull are of a prismatic shape, flattened above, and enlarged posteriorly; all the bones of the skull and face are soldered into one piece.—The head is articulated by two condyles to the ster-

num, so that the head has very little motion on the neck. The sacrum is long, pointed, and compressed, but there is no os coccygis, nor any production bearing the least resemblance to a tail. This is the more curious, because the young of all the species of frogs have tails as their only organs of motion; and one species—the Surinam frog—has this organ so large in proportion to that part which is afterwards to be developed into the perfect frog, that the young was long considered as a kind of fish.

There is something in the muscles of a frog worthy of more attention than it has hitherto received. The principle of animal life in frogs appears to be in a very extraordinary manner obedient to external circumstances; to be much less concentrated upon a peculiar organisation than that of many other vertebrated animals; and to make at least an approach to some of the modifications of *action*, which can be made to take place without the presence of any thing which we can call either animal life or organisation. It was by operating on the muscles of a dead frog, and finding that they were excited to action by peculiar applications of different metals, that galvanism, or humid electricity—electricity by chemical decomposition, was at first discovered; and though the muscles of other animals, even the warm-blooded ones, including those of man among the rest, can be excited by the same kind of action, yet they cannot be so strongly excited by so small a degree of it in proportion; and they do not preserve the capacity of being excited for so long a period after the death of the animal.

There is another circumstance in the life of animals of this family, which is also worthy of attending to, and that is the time that they will live, and the muscular parts—indeed, almost any remaining parts—perform their functions after other parts are taken away. Almost any animal can admit of having one or more of the extremities removed, and still continue to live; but any serious abridgment of the internal parts is in most animals attended by a total suspension of all motion in the remaining muscles. But a frog will not only live but leap about after the head and the greater part of the viscera are removed; and a male frog will continue the operation of fecundating the eggs for a good many hours after his head is cut off. This, and also the circumstance previously mentioned, tend to show that there is some connection between electric action and the action of life in the bodies of animals; and when we bear in mind that the life of animals is always the more easily destroyed the more that it is concentrated upon one perfectly organised system, and the more vigorously that that system requires to act in order to maintain itself in the living state; then, though we cannot see where to draw it, there is a line of distinction somewhere to be drawn, between organisation as a congeries of material substances, and action as giving what we call life to those substances; and that as when we chemically analyse the bodies of animals, we find them made up of the common elements of matter; so when we proceed to the virtual analysis of this connection between the organised body, and the action of life in that body, we feel, though we know not well how to express the feeling, that as the substance of the body is a particular modification of that substance which we can with perfect propriety generalise under the name of *matter*, so the life of the body—the merely animal life—is also a particular modification of that which we can generalise under the name of *action in matter*.

This is a very important consideration in more points of view than one. In the first place it is the analysis by which we must work out the theory of production in all organised beings, whether plants or animals, if ever we are to have any thing like rational science upon this highly interesting subject. In the second place it draws, more clearly than could be drawn by any other means, the line of distinction between matter and mind, and assigns to each the limits of its proper province. This is probably the more important consequence of the two, because even the ablest and best-intentioned of those philosophers who have treated, either of the mind of man as immortal, or of the material creation as demonstrating the being of God, have not been able fully to disentangle themselves from the meshes of materialism.

Frogs are exceedingly numerous; and in their productive powers they are more prolific than any other vertebrated animals, with the exception of fishes. Three or four hundred is a very ordinary year's produce from a single pair; and the number is often as many as a thousand. This extraordinary power of multiplication cannot, upon the general principle of the system of nature, have been given without corresponding uses. In the case of frogs, those uses are two-fold, extending both to what they eat, and what eats them. We have already attended to the first of these, in so far as man is concerned, and also taken some slight notice of the second to the same extent.

This is not, however, the proper view to take of the system of nature, if we are to understand that system aright. We are not to suppose that creation is imperfect until man puts his hand to it; for, though it has a capacity to be turned to his use to as great an extent as he can possibly stretch his knowledge, yet the system is in itself perfect without him; and wild nature goes on without the smallest embarrassment or difficulty in those places which have never been trodden by a human foot. We must, therefore, seek for those uses to which the past productiveness of frog applies, without any particular reference to man and his operations.

Now the number of small molluscous animals which the frogs consume, and of which the productive powers are also very great, and also the numbers of larvæ and other minute beings of the waters which they remove both in their tadpole and their mature state, would be productive of unseemly mischief were it not for the frogs. On the other hand, the frogs themselves supply food for a vast number of other creatures. Birds and fishes eat the eggs while they are in the waters, at that season when there is hardly any other supply. The tadpoles have many enemies; and the full-grown frogs contribute largely to the supply of fishes, of more powerful reptiles, and of many species of those birds which live on the banks of the rivers. The eggs and tadpoles of frogs are also subject to various casualties from the seasons. They are often frozen, at least the eggs are; but whether this destroys the principle of life in them, is not so clearly ascertained. A frog itself can be brought to as low a temperature nearly as that of freezing, without being destroyed; but in the experiments which have been made, we believe that actual freezing has been in all cases fatal. A more certain means of destruction is drought; for, as both humidity and atmospheric action are necessary to the quickening of the eggs, they of course perish if the water in which they have been deposited dries up. So also if the little pools and

runs of water into which the tadpoles distribute themselves are dried up, they, as breathers through water, must perish. We need not add that, for the keeping down of the excess of that on which they feed, for the supply of those animals which feed on them, and for compensating for those chances of destruction, their great fertility is required. Nor must we deem it strange, or at all contrary to the beauty of the system of nature, or the benevolent plan of its Author, that there should be a provision for those reciprocal operations of destroying and being destroyed; for all the tribes of beings must live upon each other; and it is this mutual support that forms the beauty of the system, and which enables it, taken as an entire system, to be self supported, which it could not otherwise be. At a superficial glance, we might deem this mutual destruction; but really it is the perfection of the system, and without it this earth would have required another earth to victual it, that would have required a third, and so on without any end to the succession.—in other words the system of things would have been absurd and impossible. Human society forms no exception to this, for the more that the individuals of that society depend upon one another, the more abundant and the more secure are their enjoyments, and the more are they disposed to cultivate all the kindly charities of life.

We need not describe the appearance of the eggs or spawn of frogs, as it is familiar to every one who walks in the fields in the spring months. It is, however, worth while shortly to advert to the transformation which these animals undergo. When they come out of the egg, they consist of an oval head, having a small mouth with a sort of horny mandibles, and an elongated tail, which bears some resemblance in shape to the posterior part of a fish, and has its principal motions lateral, as is the case with fishes. In this state they breathe by means of gills, not very unlike those of fishes, as they consist of little tufts of fibres fixed to the edges of small cartilaginous arches, and the water passes through the fibres much in the same manner as it does through those of fishes. In this stage of their existence, the cavity of the body extends some way into the tail; and the animal really bears some sort of resemblance to a compound of a reptile and fish. It was a long time before the real state of the case was generally known; and hence the ridiculous stories of the spontaneous generation of frogs, and of showers of them falling from the sky, of which we read in the older authors. But any one who chooses to observe water in which there are tadpoles, and they are so abundant that there are few stagnant pools without them, may see the progress of the transformation. The hind feet are the first to be developed; and they are produced not from the tail, which contains no part of the perfect frog, but from the posterior part of the head, which head in the tadpole state is both head and body, as respects the mature frog. After their first appearance these hind feet grow apace, and during their growth the tail hardly diminishes; but by the time that the feet can act in swimming, it will be found that the tail has changed both its external action and its internal structure. It has become thicker laterally, its fin-like margin has disappeared, and it does not act on the water with that lively motion which it had in the finless tadpole. Internally it has lost its muscular texture, and become a reservoir of a sort of fatty substance, which by some process that we do not very well understand, furnishes

the animal with food during the last stage of its transformation, that is of the final development of the fore feet, the shortening and change of the intestines, the development of the lungs, and the absorption of the gills; during which changes, at least in the very last stages of them, the animal can of course neither breathe nor feed in the water. Thus this curious accumulation of nourishment in the tail bears some slight resemblance to that which is provided for the chicken in the egg; and the moment that the change is completed, the tail is absorbed, the gills are gone, the lungs perfected, and the former tadpole no longer capable of breathing in that element in which it has hitherto lived, leaps out of the water a little frog.—The numbers of them that leave the ponds or streams on such occasions are very great, so many as that in particular cases four or five acres of ground have been observed entirely covered with them. Those migrating myriads are very frequently thinned by birds, or where serpents abound, by those species which frequent moist places, and the banks of rivers. It is probable that those migrations may have given rise to the old stories of showers of frogs; because, whether young or old, frogs are always most active when the air is humid.

After their transformation, they are no longer capable of breathing through the medium of water; and there is a change in the way in which they receive the air. While tadpoles they take in the water and air along with it, by the mouth; but when they acquire their perfect form, they do not use the mouth in breathing, at least in the process of inspiring or taking in air. They do this through the nostrils; and after the cavity of the mouth is filled, they elevate the tongue first, to close the nostrils, and then gradually to occupy the cavity, by which means the air is forced into the cells of the lungs, and when it has performed its office, then it is expelled, not by the action of a diaphragm, but by the simple contraction of the abdominal muscles. This is a slow process; but the system does not require very powerful action; and, when they are sporting in the water, it can be suspended for a limited time.

Frogs in their proper state cannot be considered as inhabitants of the water, though they all resort there more or less, but with different degrees of frequency in the different species. Still they are not found in very dry situations, but in marshy and boggy places, and on the margins of lakes and rivers. They resort to the water for food, which principally consists of aquatic insects, worms, and the very young fry of fishes; they also resort there for the purpose of breeding, and, as it is seen from their gambols in the water, they sometimes resort there for mere amusement.

Frogs, in most of the species at least, are understood to arrive at full maturity in about five years; and to live for about fifteen or twenty; but the latter point of course is not very well understood, and from the enemies to which they are exposed, it is probable that but few of them live out the full number of their years, and die of old age. They are susceptible of some attachment; and there have been instances in which frogs have been rendered so tame as to come when called, and take their food out of the hand of those with whom they had become familiar. We shall now very briefly mention a few of the species.

THE COMMON FROG. This species requires little description. It is by far the most abundant in the British islands, the most hardy, and the earliest breeder. They are found in many, indeed in most

countries, but with some variation of size and colour. Their general colour is a dull brownish red, something resembling the tint of a withered leaf; with a black spot on each side of the head, and produced on the sides of the neck. When their several labours of pairing are completed, they quit the parts in which they have deposited their numerous progeny; and, during the latter part of the spring and the summer, they may be seen hopping about in moist and shady places, especially in moist states of the atmosphere. When the air is very dry, they resort much to the waters, it appearing that they do not feel comfortable if their skins become dry; while they hide themselves in the tall aquatic plants, they are very quick and dexterous in the capture of water-flies, which they watch with keen eye, and spring upon with certainty. When the temperature sinks below a certain degree in the autumn, they all disappear; and it is understood that they take up their abode in the water, in that element in which they are first awakened into life, and in which they spend the first form of their existence, and undergo their transformations. This, if not absolutely demonstrated in all cases, as in the nature of things it cannot be, is yet very likely, and very agreeable to the analogy. They neither feed nor breathe during this period of the year; and as the peculiar texture and secretion of their skins protect them as completely from the action of the water as if they were fishes, they enjoy a much more uniform temperature, and, in cold weather, a warmer one than they would do in holes of the earth. It is not a little curious that animals which cannot be produced or come to their ultimate form but in the water, should resort there in order to bring forward their eggs or spawn; and yet this is in accordance with the general analogy. The young are, for some time after they come into life, to be fishes in their element, and in the more important purposes of life; and, perhaps, one might naturally expect that the eggs from which those young are to be produced, should have some resemblance in the mode of their maturing to the spawn of fishes. It has sometimes been said that at the time when frogs betake themselves to the water for the purpose of hibernating, their mouths grow together, by the one lip forming a complete adhesion to the other. This, however, is not the case, and it is not necessary. The mouth of a frog is not, as we have observed, used in the breathing of the animal, but serves merely as a prehensile apparatus in the capture of the food; and when not used for that purpose, it closes not only water-tight but air-tight. When the animal ceases to eat, it has no occasion to open the mouth; and that of course remains closed. It does not appear that they feed in the spring before the time of pairing; and thus they come out of their hibernating places, with the spawn or eggs fully matured, and ready to be excluded and fecundated, nor do they quit the waters, or eat, or move, until that operation is fully performed; and they are absolved from all family cares, quit the breeding waters, and leap about until the close of another season shall send them anew to their hibernating places, to perform the same operations. The common frog is the most prolific of all the British species; and its tadpoles afford an abundant supply of food to various species of birds which breed in the marshes.

THE GREEN OR ESCULENT FROG (*R. esculenta*).—This is not the only esculent species, for the common frog is equally palatable and wholesome, though it

does not contain quite so much muscle on the hind legs. It is not nearly so abundant in Britain as the common one. It is of a more handsome form, and more finely coloured. The muzzle is pointed; the posterior part of the body narrow, and the spine at that part arched. The upper part is green, marked with three longitudinal lines, the one on the middle of the back, forming a furrow, and the two lateral ones elevated ridges or margins. These lines are distinct and of a yellow colour; the upper part of the body is whitish, marked with blackish spots.

This species is far more abundant in France than in Britain; and in the vicinity of Paris, and in many other parts of the country, it is the common frog of ordinary parlance. It is a very active animal, and as is indeed the case with all frogs, it swims in the same way that man does, giving the most powerful stroke with the hind legs, but keeping stroke with the fore ones also. It is also an adroit leaper, and will leap to a very considerable height, and catch a fly or other winged insect with great accuracy. The very warm weather is mentioned as the time when it is in the most active state; and it can bear the strength of the sun on the warmest days of summer. It then takes post among the aquatic herbage on the margins of the pools and streams, and sits watching for its prey, with its head immovable, its legs prepared for the leap, and its eye intently looking out, and undazzled by the most powerful heat of the sun. When a fly comes within the range of its powers, which it appears to be capable of estimating with very great exactness, it darts with the speed of an arrow, and very seldom misses its object. Without reference to the estimation in which it is held by the continental gourmands, the edible frog is far from being an uninteresting reptile; but as it has no value for the larder in Britain, it is not studied or appreciated to the extent which, in a natural history point of view alone, it seems to deserve.

NATTER-JACK FROG (*R. rubeta*). This is also a British species, though understood to be more rare and local than the esculent frog; but, for the reason mentioned in noticing that one, it is probably much more abundant than is generally supposed. It differs in its habits from the other two British frogs, being found chiefly on the heaths and commons which are comparatively dry, with only occasional pools and bushes. It is to be found on most commons of this description south of the Thames, and also in some parts of the midland counties. It is covered with small punctured tubercles, which give it something the appearance of a toad. It is much more broad and blunt posteriorly than the other frogs, and its hind legs are shorter, feebler, and much less supplied with muscle. Its gait is peculiar, not being either the leaping of a frog or the crawling of a toad, but something intermediate between the two, a lumbering and unseemly sort of walk, by which, and by its tuberculated skin, it is easily known. The colour on the upper part is yellow, marbled with brown, and there is a tolerably well-defined yellow line down the middle of the back. It is an obscure-living reptile, and not often seen, so that little or nothing is known of its manners.

THE DOTTED FROG (*R. punctata*) is ash-coloured on the upper part with small green dots. The feet are marked by transverse bands, and the toes of the hind feet are webbed for only part of their length. It has been observed in the neighbourhood of Paris,

and in some other parts of France, but it is as rare there, and its manners are as little known, as the natter-jack in England. The species which have been seen are very small, not exceeding one inch in length; but whether it attains a larger size than this is not known.

THE PLAITED FROG (*R. plicata*). This is also a small species, about the same size as the dotted frog. It is a native of the warmer parts of France, and probably of the north of Europe generally. It gets its trivial name of plaited from having two transversely oblique plaits or folds upon each plane. Its colours are, brown on the upper part, and grey on the under. The toes of its fore-feet are entirely free, and those of the hind feet are only half webbed. Those semi-palmated frogs indicate a much less aquatic habit than those which have the toes completely webbed.

ALPINE FROG (*R. Alpina*). So little is known of the species which has been described under this name, that it is not very easy to decide whether it be really a distinct species, or only a coloured variety of the common frog. This is the more puzzling, that, in the mountainous parts of this country, the frogs are small and very dark in the colour. The writer of this article has often seen them in the Highlands of Scotland, but did not at the time examine if they had any characters specifically different from those of the common frog. The Alpine frog is described by Laurenti as being wholly black, and as being found only in the mountain of Schneeberg, in Austria, a mountain which is famed for the richness of its botany.

These are the principal species of European frogs that have been noticed and described; but the probability is, that there are many more species; for here, as in the case of the whole class of reptiles, the information which we possess bears no proportion whatever to the extent of the subject. In the case of the extra-European frogs, it is, as might be expected, still worse. Many species have no doubt been named, but little is known of them, and our limits will permit us to mention only a few.

SURINAM FROG, OR JACKIE (*R. paradoxa*). In the tales of describers of animals, this is one of the most notorious, if not celebrated, of all the foreign frogs. The trivial name *paradoxa* is absurdly applied, and should be discarded, were it not that it is a memorial of the credulous folly of former naturalists, and may be a beacon to their successors. There is no "paradox" about this frog, or indeed about any animal, for all are equally well adapted to the purposes which they answer in nature, and the paradox is the sole property of the ignorant describer. Hence it were advisable that the paradoxes of naturalists should be treated in the same manner as the paradoxes of the Vicar of Wakefield. "The world said nothing at all about my paradoxes," said the simple-hearted Vicar; and truly it were wise, that not the public only, but the naturalists themselves, said nothing at all about their paradoxes.

The paradox, while it remained one, was this: Other frogs are tadpoles, which have something of the fish about them, and these tadpoles turn to frogs; but in the case of the Surinam frogs the order of things was completely reversed. The story was, that this creature, after having been once a frog, afterwards turned to a fish; that the fish was much larger than the frog, and that it was eaten by the natives under the name of "Jackie," or the frog-fish.

By what sort of metamorphosis it first became a frog, they did not state, and in all probability they never inquired. They saw the frog, and they saw the fish, as they considered it to be. The fish was very considerably larger than the frog, and that a large animal should grow small was the paradox; and as they could not go this length in their simple belief, they believed in something a good deal more paradoxical, namely, that in this frog the process of nature is reversed, and that it is frog first, and larva or tadpole afterwards. Such a reversal of the order of nature would have been truly marvellous, because there is nothing analogous to it, throughout the whole system, in any member of any class of that system which undergoes transformation, and change of element and breathing apparatus. Many creatures breathe through the medium of water when they are in their first or larva state, and afterwards, when they undergo their changes, and arrive at their perfect or final form, the only form under which they are capable of propagating their species, and which they are to retain till they die, become breathers of the free atmosphere. This is the case with all the frogs, and indeed with all batrachian reptiles; and the story of a frog turning into a fish was about as ridiculous as that of the barnacle shell turning into a wild goose, which was so gravely believed, that learned men set it down in print that they had actually seen the process going on in some duck-pond or other in England, where a barnacle, which is entirely a production of the sea, could not by possibility exist. Now, the Surinam frog is just as guiltless of becoming a fish, as those curious mollusca, which bear their shells at the end of long peduncles, which are fastened to a rock, or, in preference to floating wood, a ship's bottom, or anything else, are of changing to geese, though the reporters in both cases stand in some jeopardy of at least a metaphorical transformation of this kind.

This story, like the former, and many others equally absurd, passed current in the books down to about the year 1816, when Mr. W. M. Ireland studied the frog through its change from the rudimental tadpole to the perfect reptile; and Sir Everard Home gave some demonstrations, aided no doubt by the scalpel, the microscope, and the pencil of the highly-talented and most indefatigable Francis Bauer, of the internal structure of the tadpole in two different stages of its growth. The actual observations by Mr. Ireland might have been enough to set completely at rest a question upon which rational men could have but one opinion; but still, as it is difficult to drive the nail of conviction into some heads without the hammer of heavy authority, it was as well that Mr. Ireland's clear and satisfactory account was fortified by the demonstrations of Sir Everard. The following is the substance of Mr. Ireland's communication, which was published in Brande's Journal for 1816:—When first seen by Mr. Ireland, the tadpole was about four inches and a half long by about an inch broad; had a large head and small mouth, very much resembling those of a fish, though the rudiments of two legs were evident just behind the head. In about a fortnight the length of the animal had increased to eight inches, and its breadth to about two and a half; and the rudiments of the legs were developed into nearly perfect members, with five-clawed toes, united by a membrane, evidently the future hind legs of the animal.

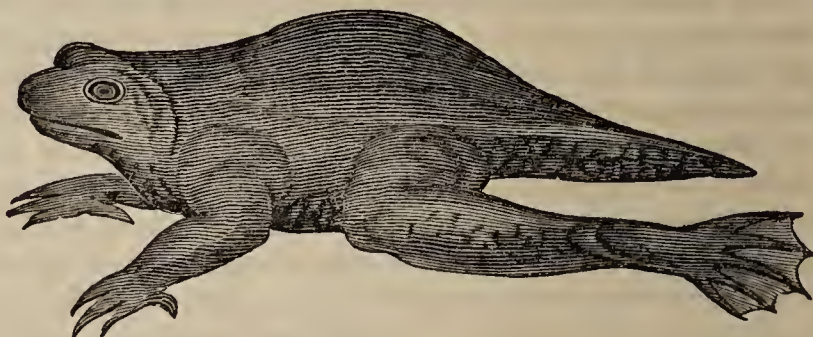
On examining its internal structure during this fortnight, the intestinal canal appeared very long and

coiled up, and the rudiments of the lungs were seen in the posterior part of the belly.



Tadpole of the Surinam Frog, a quarter its length.

In about three weeks the fore legs made their appearance, the head and mouth assumed their ordinary figure, the former being considerably smaller, and the latter larger than before; and the animal, which till now had lain at the bottom of the vessel in a torpid state, became more active and lively, and usually remained suspended in the water, with its mouth above the surface. By this time the intestinal canal was wonderfully altered in extent and appearance, being contracted apparently to less than half its length, and having but very few short convolutions, and nearly the whole of the cavity of the belly was filled with fat.



Surinam Frog, nearly full-grown, one half of real length.

In about six weeks the animal was greatly contracted in size, being little more than three inches long by about an inch in breadth, and had become a perfect frog, except some small remains of the tail, which had been gradually sloughing off or absorbed, and the disappearance of which had so greatly contracted the animal's length.

THE BULL-FROG (*R. pipiens*). This is a very large species, by much the largest of the genus, measuring not less than eighteen inches from the muzzle to the extremities of the hind feet. The upper part is dull green, mottled with black, and the under part whitish grey, with black spots. There is a copper-coloured circle on each side of the head, which surrounds the tympanum, and points out the place of the ear. It usually posts itself at the mouth of its hole, by the side of the water. It is difficult to take, being very agile, and capable of leaping to the distance of ten or twelve feet at one bound. It is also very voracious, feeding chiefly upon fish, though it is also accused of swallowing ducklings, and even goslings, in their very young state. The real bull-frog does not appear to be very common, as not more than a single pair usually occurs in the same pool or patch of marshy ground. Cuvier is of opinion that various species of frogs are confounded under the general name of bull-frogs in the United States, where these reptiles are of great annoyance to those who reside near marshy places, which places are by no means of rare occurrence in America. The common name of bull-frog is given from the resemblance which the croaking of this species bears to the bellowing of bulls. It is equally loud, if not louder; and as it is carried on incessantly during the night, sleep is out of the question with the stranger who first takes up his quarters in the neighbourhood of the bull-frogs haunts.

THE PITPIT-FROG (*R. halecina*). Rather smaller than the former; green above, with brown spots, and yellow dots in the centre. This species has been confounded with the bull-frog; but, besides the difference in colour, it is much longer in proportion to the thickness, and still more agile, being capable of leaping fifteen or eighteen feet at one bound. It is very common in the marshy places of the southern states of America, and its noise is even more disagreeable than that of the bull-frog properly so called. This, however, is one of the bull-frogs of America.

EYE-SPOTTED FROG (*R. ocellata*). This is a very large species, and inhabits to the southward of the former one, as that appears to do of the common bull-frog. It has been found in Guiana as well as in those parts of North America which border on the Gulf of Mexico, and which are remarkable for the abundance of aquatic reptiles of all kinds. Its general colour, on the upper part, is brown, and that on the under part white; and there are very distinct eye-spots on the flanks and sides.

GRUNTING FROG (*R. grunniens*). This species is very nearly equal in size to the bull-frog. Its colours are a mixture of brown and bluish and reddish, with yellow spots in the rear of the eyes. It is found in the Floridas, and also in shady places of the West Indian islands, where it is vulgarly called a toad. It seldom comes abroad except during the night. The country people, in some of the islands, are said to rear this species in a domestic state, and they find its flesh very nourishing. It is very active in the rainy season, and can jump over an inclosure five feet in height; but during the dry season it becomes inert, and passes its time in a sort of hybernation; thus affording evidence that the dry season, notwithstanding its excessive heat, is the real winter in tropical climates.

THE NOISY FROG (*R. clamitans*). This species has been found in the marshes of Carolina, not far from Charleston. In form it approaches the common frog of Europe, and its length is not above two inches. Its colour is dull ash, irregularly spotted with small black points; and, notwithstanding its comparatively minute size, the din which it makes is said to be more intolerable than that of even the larger frogs.

Such is at least a specimen of the foreign frogs, but it comprises only a very small portion of the number. The Surinam frogs and the bull-frogs are, however, the most renowned, the former for their fabulous history, and the latter for their intolerable noise, in the practice of which they actually drown the bellying of the night herons, the hissing of the serpents, the yelping of the prairie dogs, and the whole concert of villainous sounds which vex the ear of night in the wilds of America. There are several species in South America, in the south of Asia, in the Oriental Isles, and, in short, in every part of the world; and it should seem that these foreigners are, generally speaking, more noisy than the natives of Europe. It is said, that one brought from the Mauritius to Paris serenaded in so strong and harsh a key, as to drive the evening promenaders from the whole Champ de Mars, so that they were under the necessity of putting a summary stop to his music.

We shall not enlarge more upon this exceedingly numerous, and by no means unvaluable genus of reptiles; but we may have occasion to notice a little more of the duties which the batrachia have to perform in the general economy of nature, when we come

to notice the other two genera or sub-genera, which we propose to do under the titles TREE-FROG and TOAD, in their proper order in the alphabet.

FROG-HOPPER, or CUCKOO SPIT-INSECT. The small insect known under the systematic name of *Cercopis spumaria*. See the article CERCOPIDÆ.

FROG ORCHIS is the *Gymnadenia viridis* of Richard, a common British plant found in damp meadows. It is the *Satyrium viride* of Linnæus.

FUCHSIA (Linnæus). A genus of beautiful flowering shrubs, natives chiefly of South America. Class and order *Octandria Monogynia*, and natural order *Onograriæ*. Generic character: calyx tubular and coloured, the limb five-cleft; petals fixed to the throat of the calyx, connivent, and convolute; stamens included, joined in a double series to the tube of the calyx, or protruding alternately short and longer; anthers oval and erect; pollen glutinous and triangular; style filiform; style headed or four-cleft; berry four-celled, four-valved, and many seeded. This is one of our most common greenhouse plants, and will stand in the open air if defended from frost. It is easy of propagation by cuttings, and deservedly a great favourite. There are nearly a score of different species and varieties of it in our collections.

FULGORIDÆ (Leach). A family of hemipterous insects belonging to the sub-order *Homoptera*, Latreille, and to the division *Cicadariæ*, being destitute of organs for producing a sound, having the antennæ inserted beneath the eyes, only three-jointed, terminated by a long slender bristle; two ocelli or none; legs formed for leaping, and the front of the head produced into a kind of snout, variable in size and form in the various species. Here belong the genera *Fulgora*, *Otiocerus*, *Lystra*, *Cixius*, *Pæcilopecta*, *Issus*, *Anotia*, *Asiraca*, *Delphax* (which see), *Derbe*, and several other genera recently established upon structural characters.

Of the habits of these insects but little is known, they are herbivorous in all their states, sucking the juices of plants by means of their long-jointed proboscis, which is ordinarily concealed, laying along the breast. In the typical genus *Fulgora*, are placed the largest species of the family, having the ocelli distinct, and two in number; the antennæ are destitute of appendages, and the front of the head is produced into a large hollow snout-like proboscis, respecting which great differences have prevailed amongst naturalists; this part of the body being generally considered as emitting a very bright light, whence the insects have derived the name of lantern flies. And it is said, that the luminous matter is diffused through the hollow semitransparent projection of the head. Of these



Fulgora laternaria.

the Chinese *Fulgora candelaria*, and the South American *F. laternaria* are the more conspicuous. If this be the case, it must be evident from the large

size of the insects, which measure several inches across the wings, that the light must be very distinct, and that the appearance of the trees studded with these living lights must be exceedingly beautiful. The chief testimony in favour of the existence of this luminosity is Madame Merian, who tells us that the Indians had brought her several of the *Fulgoræ laternaria*, which, by day-light, exhibited no extraordinary appearance, and she inclosed them in a box until she should have an opportunity of drawing them, placing it upon a table in her lodging-room. In the middle of the night the confined insects made such a noise as to awaken her, and she opened the box, the inside of which, to her great astonishment, appeared all in a blaze; and in her fright letting it fall, she was not less surprised to see each of the insects apparently on fire. She soon, however, divined the cause of this unexpected phenomenon, and removed her brilliant guests to their place of confinement. She asserted that the light of one of these *Fulgoræ* was sufficiently bright to read a newspaper by; and though the tale of her having drawn one of these insects by its own light is without foundation, she, doubtless, might have done so if she had chosen.

Notwithstanding this positive statement, it is to be observed, that from the accounts of some recent observers, there is great reason to distrust its correctness—no one author or traveller having distinctly asserted that these insects are in the least luminous; whilst several, as M. Lacordaire, M. Richard, and Dr. Hancock, who have seen these insects alive, have not observed them to be luminous. One species of this genus, of small size, the *Fulgora Europæa*, is reputed to be an inhabitant of this country.

FULICA—Coot. A genus of birds belonging to Cuvier's sub-order *Macroactyles*, or long-toed birds; and as a Linnæan genus including the **GALLINULES** and the **SULTANA-HEN**, under which names we shall notice these birds; and thus we shall be enabled to restrict our present notice to the coots properly so called.

With this restriction the generic characters are given as follows:—The bill middle-sized, strong, conical, straight, compressed, much deeper than broad at the base, the ridge projecting in front, and dilated into a naked plate; both mandibles of the same length, the upper slightly curved and widened at the base, the lower forming an angle; nostrils lateral in the middle of the bill, longitudinally cleft, half closed by a membrane, and pervious; legs long, slender, naked above the knee, all the toes very long, connected at their base, and furnished along their sides with scalloped membranes; wings middle-sized. The coots are more decided residents in the water than even the gallinules, being rarely seen on land, living and travelling in the liquid element, and swimming and diving with equal facility. But they inhabit fresh waters, gulfs, and bays, and venture not into the deep and open seas. Although individuals of the same species vary considerably in dimensions, the sexes are with difficulty distinguished, and in appearance the young differ very little from the adults. Their food chiefly consists of aquatic vegetables and insects.

COMMON COOT (*F. atra*). This is a general resident in the old continent, and also in America; and it remains in the British islands the whole year without migrating. The size is nearly the same as that of a common fowl, the average length being eighteen

inches, and the spread of the wings about twenty-eight. The weight varies from a pound and a half to two pounds, according to the condition of the bird. It breeds early in the spring, the female generally constructing her nest of a large quantity of coarse dry herbage, as flags and rushes, well matted together, and bound with softer and finer grasses, in a bush of rushes, surrounded by the water. By heaping the materials together, she raises the fabric sufficiently above the water to prevent the eggs from getting wet; but as this sort of structure very often renders it too conspicuous to the buzzard, and other birds of prey, the old females, instructed by experience, place it on the banks of the streams, and among the tallest flags, where it is much better hidden from the view. It being kept in a buoyant state, a sudden flood, attended by a gale of wind, has been known to drive it from its moorings, and to float it from one side of a large piece of water to the other, with the bird still sitting on it. The female lays from twelve to twenty-one eggs at a time, and mostly hatches twice in a season. The eggs are about the size of those of a pullets, and of a pale brownish white, sprinkled with numerous dark spots, which run into blotches at the thicker end. These eggs are sold in Holland, before they are sat upon, and fetch a considerable price in the market. The incubation lasts twenty-two or twenty-three days. The young soon after quitting the shell dive and plunge into the water swimming about with great ease, and, though they do not return to the nest, nor take shelter under their mother's wings, they still for some time gather about her, skulking under the flags. At first they are covered with a sooty down, and are of a shapeless appearance; and before they have learned to shun their enemies, they are frequently sacrificed to the rapacity of the pike, the moor buzzard, the kite, and other birds of prey. In the isle of Sheppy this species breeds very abundantly, and the inhabitants will not suffer their eggs to be taken, as the bird forms a considerable article of food. On meagre days they are eaten by the French; but, though skinned before dressing, they are not very palatable to every appetite. The common coot is a very poor traveller, and waddles with much apparent difficulty from one pool to another, with an awkward gait. It usually lies concealed among the water plants during the day time, rarely venturing abroad except in the dark, or at night in quest of herbage, seeds, insects, or fishes, the light very probably dazzling its imperfect vision. It can seldom be forced from its retreat by the sportsman and his dog, and rather than spring up it will bury itself in the mud, or if compelled to rise from being very closely pursued, it rises with much fluttering and apparent difficulty. As the foot of the coot has sometimes been described, by those who do not take into account the functions which an organ has to perform along with the shape of that organ, we shall quote a passage from Mudie's Feathered Tribes, as illustrative of the action of the coot's foot. "The legs," says Mr. Mudie, "are placed farther backwards than in any of the birds that live chiefly on land, but they did not appear to be farther back than they are in reality, from the degree to which the tarsal joint is extended when the bird walks."

"It has been said, and the saying has no doubt been founded on that very bending of the tarsal joint, and the tendency that the toes have to collapse the instant that the foot is off the ground, that the coot

walks with great labour and difficulty. But the foot of the coot is another of those instances, of which there are not a few in the structure of birds, in which the very master-pieces (so to speak) of nature's mechanics are considered clumsy, for no other reason than because we will not examine them, and find out why they are thus constructed. The coot's foot has a compound function to perform, and therefore it must be a compound instrument. We look at it only in one of its uses, or rather we look merely at its form, (for when used either way it is used cleverly), and hence we draw the conclusion—from our own ignorance. In order that the coot may properly fill that place which appears to be assigned to it in the economy of nature, it must swim, and also walk, and even climb a tree upon emergency; and though it is not launched upon the broad waters like those pelagic swimmers that fish, or capable of procuring its food by the touch of a dabbling bill like the swimmers in the shallows, it must swim to considerable distances, and with some rapidity. In order to do that, it must have the centre of gravity considerably in front of the articulation of the legs, so that these may act in the wake of the body, and have the advantage of the eddy. It must also swim clean, and without those projecting feathers which are found on the sides of the gallinule, and which, though they assist in making it buoyant when moving slowly, would either impede a quick motion, or be flattened to the sides, and have their buoyancy destroyed by it. The form of the body, the position of the legs, and the extent of the toes, with their lobed margins, answer these purposes remarkably well, and the coot is a very efficient swimming bird. But, again, the coot has to walk, and so that is a lifting motion, while swimming is merely a pushing along, the weight being supported by the water, some modification is required. The swimming foot is converted into a very efficient walking foot, by that very bending of the tarsal joint which, to us, makes the leg appear so awkward. The bending of that joint, without any muscular effort, pulls the tendons that compress the toes, and slackens those that resist that compression because the former tendon passes over the outside of the bend at the tarsal joint, and the latter along the inside. The toes are very long; and the tendons pull them to their extremities, so that the centre of support in the foot is thrown far before the articulation of the tarsal, and by the action of the same spring the weight of the body, is, at every step, discharged from and received by the points of the toes, which it could not be, if the tarsal joints were not bent. The toes being free, too, and not joined by a continuous web, enables the spring of each to act to the full range of its articulations, and the foot to adapt itself to any form of surface upon which the bird may have occasion to walk. Even the produced hind toe has its uses in throwing the foot upwards, and also in walking upon grassy and other elastic surfaces."

The foreign species of coot which have been enumerated by various authors, differ but little from the common coot excepting in size. That of Java is very similar to the European. But the Indian one mentioned by Colonel Sykes, merits notice in the terms in which the colonel himself describes it. It "differs only from the Javanese specimens in being larger, and a shade lighter below. Much larger than the common coot of Europe, but with the same coloured irides (crimson), and does not otherwise differ. Length

inclusive of tail eighteen to nineteen inches: tail two inches. It has the habits of *Podiceps* (Grebes) and, with the gizzard, long cæca, and general internal organisation of a duck, seems to belong to the order *Natatores* (swimming birds). Water weeds and coarse sand found in the stomach."

The only species which Cuvier admits in the Regne Animal as different from the European, is the crested coot of Madagascar (*F. cristata*). It is all over of a bluish black colour; bill white, but red at the base; frontal plate red, rising up and forming a crest; feet black; and length about seventeen or eighteen inches. The habits quite unknown.

FUMARIACEÆ. A natural order containing six or seven genera, and many species. The plants associated by their general similitude to *Fumaria*, to form



Fumaria lutea.

this type, are non-lactescent herbs, with sometimes tuberous roots, and brittle glabrous stems. The leaves are usually alternate, compound, sometimes cirrhose, and destitute of stipules. The inflorescence is racemose, the pedicels furnished with bracteæ, and the flowers irregular and united. The calyx is free, small, and membranaceous, and formed of two sepals which are deciduous. The petals are four, set cross-wise, deciduous, either discrete or coalescent by their claws, the two external ones alternate with the sepals, and either one or both saccate at the base; the two inner ones alternate with the outer, hardish at the tops, where they are coloured by a terminal spot, and connected so as to enclose the anthers and stigma. The stamens are six in number, the filaments diadelphous, united into two bundles, which alternate with the two inner petals, and are therefore opposite the outer ones. The anthers are six, the lateral in each bundle being one-celled, while the central ones are each two-celled. They are small, erect, and open longitudinally. The germen is formed of two connate seed-vessels, the style filiform, and the stigma two-plated and parallel with the internal petals.

The *Fumariaceæ* are innocuous plants, inodorous, herbage bitter, and which has been esteemed slightly diaphoretic and aperient. *F. officinalis* is the *Fumus terræ* of the older herbalists, so called from the light and smoke-like cloudiness of its foliage, whence the modern generic name *Fumaria*. *Corydalis bulbosa*, which has thick roots abounding in fecula, is resorted to by the Kalmucs in winter as food.

FUNGI. This extensive collection of plants forms the ninth order of the class *Aphyllæ*, belonging to the grand division *Cellulares*. It contains all the mushrooms, mildews, &c., found on decayed vegetable or animal matter. Many doubts have been entertained of the exact nature of these plants, some believing them not vegetable but animal productions, while others have denied that they are either, but some fortuitous effects of nature. But all these speculations have been shown to be based on error, and no one now denies that fungi are truly plants.

Fungi and insects have not inaptly been called "the scavengers of nature," for both labour, and with astonishing effect, in the removal of refuse matters, which, were they left on the surface of the earth, would be found not only useless incumbrances, but injurious tenants. The fungi are for the most part parasitic plants, and chiefly grow on dead or decaying substances. These they help to disintegrate and dissolve, and speedily remove, converting the exuvie of one generation into manure and vegetable mould for the support and sustenance of the next. For these duties, their minute seeds and wandering habits particularly suit them. See *MUCOR*, *MUSHROOM*, &c.

FUNKIA (Sprengel). A genus of hardy perennial herbs, natives of China and Japan, introduced in 1794, under the name of *Hemerocallis*, but separated therefrom by Sprengel. Generic character: corolla bell-shaped, swollen at the base, contracted above the germen, limb in six divisions, somewhat gaping; stamens filaments inserted into the bottom of the tube declining; anthers incumbent; style declining; stigma obtuse; capsule three-celled, many seeded. Propagated by division.

FURCROEA (Ventenat). A genus of tropical perennials allied to the *Agaves*, being succulent and treated as aloes usually are. They belong to the natural order *Bromeliaceæ*.

FURZE is the *Ulex Europæa* of Linnæus, a well known plant inhabiting waste ground and commons. It is extensively cultivated in some places where the land is poor, and cut every second or third year and made into faggots for the use of lime and brick kilns. It is also used as fodder for horses, being mown when very young, and bruised in a mill to soften its spines. Although its principal flowering season be in May and June, it flowers at every other season, it being a rare thing to see a patch of a dozen plants without some one or other of them being in flower.

FUSUS (Bruguère; *MUREX*, Linnæus). This genus of shells has very properly been separated from the confused Linnæan genus *Murex*, in which was included all the species not having thickened bands, without distinguishing the genera *Pyrula*, *Pleurotoma*, and others, now forming well defined genera. The shells of this genus, as it is now established, are of a fusiform or spindle shape, whence the name; the whorls ventricose at the lower extremity, and without varices, or longitudinal thickened bands on the spire or body. The columella is rarely plaited, as in the *Fasciolaria* and *Turbinellæ*, the right lip exhibits no slit, as in the *Pleurotomæ*, and the long produced turretted spire clearly distinguishes them from the *Pyrulæ*. These molluscs may be described generally as being turretted, with a transverse or nodulous keel, sometimes striated longitudinally; the columella plain; aperture canaliculated at the base, and ending in a channelled beak, frequently longer than the spiral whorls; the right side of the

aperture in adult examples is always toothed or crenulated; it possesses an epidermis, and an oval shaped horny operculum, with a lateral summit. Lamarck enumerates thirty-seven recent species all marine shells, three or four of which inhabit the northern regions, the others are only found in the eastern seas. France furnishes numerous fossil species, and they are also often found in this country. For their classification, see *MUREX*.

GAD-FLY. A term of indefinite signification applied to various species of dipterous insects which are troublesome to horses and cattle. In the Introduction to Entomology, Messrs. Kirby and Spence apply it to the species of *Æstridæ*, giving to the *Tabanidæ* the name of horse-flies; but in "The New World of English Words throughout the Artes and Sciences," published in 1658, we find the "gaddefly" described as a certain insect which stings cattle, called also a "brie," and the "brie or brieze" is therein described as a kind of fly, called a horse-fly or gad-fly. Now as the *Tabanidæ* alone sting or rather bite cattle, and as the term breeze has certainly occasionally been applied to the insects of the other family, it will prevent all further confusion by describing the two groups of insects, and their respective modes of tormenting these useful animals, under their scientific family names.

GADOIDÆ—the Cod family. A family of soft-finned fishes with sub-brachial fins, or with the two under lateral fins, which answer to the hind legs of the mammalia, situated on the throat immediately under the gill-openings. They compose the first of the three families into which Cuvier divides the soft-finned fishes which have their under fins below or in advance of the pectorals, and the bones which support those fins are joined immediately to the bones of the shoulder. The family consists only of two genera,—the great genus *Gadus* or cod, and the genus *Macrourus*, to which the continental ichthyologists give the name of grenadiers. The last genus consists of only two species, and these are but little known. They inhabit the depths of the Mediterranean, and of some parts of the temperate regions of the Atlantic. They are not very often caught, and their manners are obscure; but we shall have to give some short notice of them in a subsequent part of this article.

The genus *Gadus* on the other hand is exceedingly numerous both in species and in individuals; and taking them altogether they may be regarded as the most valuable fishes in the sea in an economical point of view. They are caught in vast numbers, many of them are of large size; and though there are differences of flavour in the different species, and even in the same species, according to the ground on which it happens to feed, and the condition in which it is when taken, the flesh of the whole is light, wholesome, and agreeable. It possesses another advantage over that of most fish, that it admits of being more perfectly cured by salting, and in this way, either salted moist, or dried, it furnishes a vast quantity of food for the inhabitants of those countries where, from the nature of the seas, or from the countries being situated inland, fish in the recent state cannot be obtained. If we take this genus altogether, perhaps they are more wholesome and also better flavoured than almost any other fishes; and, though this circumstance lessens their value in the estimation of those who are curious in fish, yet they are, gene-

rally speaking, cheaper than any other product of the sea, or even of the land, which remains equally long in season. The flesh of the whole of them is remarkable for its whiteness; and they are on this account called white-fish, and the establishments for the capture of them the white fishery.

They are rare, if found at all, in the tropical seas; but they are very abundant in the cold and temperate ones, the north Atlantic, up almost if not altogether to the polar ice, being the grand place of their resort. When they are most in season they are, generally speaking, gregarious, resorting to the banks in countless multitudes; but it is generally understood that when they quit those banks they do not remove to any very great distance, so that by judicious management on the part of the fishers, it is probable that some of the species might be found in abundant numbers and in good condition all the year round.

In a genus so numerous there must of course be different degrees of productive power in different species, but taken on the whole they are among the most prolific of fishes. The common cod fish, which is, taking both quantity and quality into account, the most valuable of the whole, multiplies at the rate of between two and three millions at a single spawning; so that it is altogether impossible for any fishing which men can carry on very much to thin their numbers.

The general characters of the cod family are: the body moderately elongated but tapering considerably to the tail, and a little compressed laterally; the skin covered with soft scales, of medium size or rather smaller, but the skin of the head without any scales; the jaws and the posterior part of the vomer covered with teeth, which are of unequal size, but generally rather small, and placed in several rows arranged card fashion, or the tooth in the one row against the interval in the other; the gills and gill-openings are very large; the gills consisting of seven rays; all the fins are soft, with the exception of a single ray in the anal fin in some of the species; in general there are two or three dorsal fins, of which one or two are in rear of the vent; the caudal fin is very distinct; and the ventral fins are attached to the throat, and pointed at the extremities. In some of the species the gape is very wide; in all the stomach is in the form of a large pouch, very strong, and there are numerous cœcal appendages, and a long intestinal canal. They are all provided with a large air bag, which is sometimes notched or toothed at the sides. The species are so numerous, however, and differ in so many of the details of their character, that it is impossible so to frame a general description as that it will meet them all.

Though these fishes are seasonably gregarious upon the banks, in the same manner as the flat fishes, they inhabit places of somewhat different character even then, and at other times they are much more discursive through the waters. It does not appear that they feed much upon ground substances, but rather upon the fry of other fishes; but in this respect the habit varies considerably along with the species. In some, as in the common cod, the young are rarely seen near the shores, but appear rather to reside near the banks. Others, again, in their young state, literally swarm on the shores, and in the harbours, and appear to prefer running water, whether of tide or of current to that which is more still.

While some of the species are found only on banks,

or where there are rich bottoms, others of them frequent rocky grounds, and those which do so are, generally speaking, smaller in size and firmer in their flesh than the inhabitants of the banks. Taking the British seas altogether, there are perhaps more species on the south coasts; but the numbers increase northwards. The sea on the east coast, which is full of banks, the mouths of the rivers, and also in mid-seas where the currents of tide meet and form their deposits, these fishes are very abundant. In this sea they are, however, usually found at a good many miles distance from the land, unless it be in the species which resort to the shores, and which are always inferior in quality to the far sea ones. In the western seas they are perhaps even more numerous; and along the west coast of Ireland, and especially on the west of Scotland among the isles, where the disturbed currents of tide have deposited numerous small banks, they are found in numbers which are almost incredible, not on the banks only but in the channels, and openings of the sea lochs, or deep and narrow bays by which the coasts there are so much indented. They are also exceedingly numerous among the northern islands; and perhaps there are as abundant fishings near the Shetland islands as in any other part of the British seas. Indeed, white fish of some species or other, either fresh from the sea, or dried in the sun, or salted, forms a very large item in the every day food of the people there. The same may be said of Iceland, of the Faroe islands, and of many parts of the coast of Norway. The grand head quarters of the race, at least of the common cod, in an especial manner, seems to be the great banks of Newfoundland, which are, perhaps, taken altogether, the largest deposits of sand, gravel, and mud, which is any where to be met with. From this, they spread themselves in the direction of the current of the water, which may be said to set from this bank across the Atlantic, and to extend as far to the south as the shores of the bay of Biscay. The species which are most abundant differ a good deal at different places of this wide range of the sea; but still, taken on the whole, they are more numerous here than in any other part of the world; and they give a value to those seas which no other seas can be said to possess.

When we say that the range of these fishes extends as far southward as the bay of Biscay, we must not be understood as implying that they are distributed in equal numbers through the whole of this range; for the numbers diminish as we proceed southwards, while the great mass may be regarded as not extending much further to the south than the coasts of Scotland. The species most abundant and best, to the south of this, is understood to be the common cod; and there is no fishing on the south coast of England for any of them which can be regarded as very productive, unless it be for the whiting, which is far from being one of the most valuable. Some rare ones are occasionally met with on the southern shores that have not been noticed in the north; but then, on the other hand, there are several so numerous in the north as to be taken both for local consumption and for sending dried or salted to other markets, which are very rare in the south. We shall be better able, however, to notice the few particulars with regard to locality which our limits will afford, when we come to speak of the different species. The genus has sometimes been divided into as many as seven sub-

genera ; but we shall not formally notice their distinctions.

COMMON COD (*G. morhua*). This is the species which is most valuable as an article of commerce. The fins are large, the body is thick toward the head, and tapering to the tail ; the first ray of the anal fin is spinous ; the colour above is grey freckled with yellow ; and that below is white. The lateral line is straight till opposite the vent, but bends toward the tail, where it becomes white and broad. The termination of the caudal fin is nearly straight. It is understood that, in the British seas this fish deposits its spawn in the spring ; but from the fishing season, as afterwards to be mentioned, on the great bank of Newfoundland it is probable that the spawning time there is different.

The following account of the fishery on the great bank of Newfoundland will show the immense value of the common cod in a commercial point of view :— On the east and on the south of the island there are several banks of sand, that rise from the bottom of the river, the greatest of which extends nearly ten degrees from south to north. The stillness and comparatively mild temperature of the water, in their vicinity, attracts so many shoals of cod that the fisheries which are established there supply that article to the greater part of Europe. These animals quit the banks about the end of July and during the month of August. The fishing season begins in April, and ends in October. The length of the cod seldom exceeds three feet, and the conformation of its organs is such as to render it nearly indifferent to the choice of its food. The voracity of its appetite prompts it to swallow indiscriminately every substance which it is capable of gorging ; glass and even iron have been found in its stomach ; by inverting itself, it has the power of discharging these indigestible contents. The fishermen range themselves along the side of the vessel, each person being provided with lines and hooks. As soon as a fish is caught, they take out its tongue, and deliver it over to a person in whose hands, after having undergone a certain degree of preparation, he drops it through a hatchway between decks, where part of the back bone is cut off, and the cod, in order to be salted, is thrown through a second hatchway into the hold. Whenever a quantity of fish, sufficient to fill one of the vessels, has been taken and salted, she sails from the banks to the island and unloads her cargo. The ship returns again to her station, and in the course of the season completes four or five different freights. The fish are dried on the island, and larger vessels arrive from England to convey them to the European markets. Much care and attention are required in packing this article ; the greatest precaution is used to preserve it from the moisture of the atmosphere. A person denominated a culler, or inspector, attends the loading of each vessel, in order to see that all the fish are completely cured before they are put into the cargo, which might otherwise be soon damaged. The price of dried cod at Newfoundland is commonly fifteen shillings the quintal, and is sold in Europe for about a pound sterling. In a vessel with twelve men there must be 10,000 fish caught, salted, and brought into market from the middle of April to July, else the owners will be excluded from all claim to the established bounty. Such a crew, however, takes usually during the season more than double that quantity. The English merchants, who are engaged in these

fisheries, supply the sailors upon credit with whatever they stand in need of, and are repaid at the end of the year with the produce of their industry. Several hundred thousand pounds are thus annually advanced on an object of commerce before it is taken from the bosom of the deep. About 400 ships, amounting to 36,000 tons' burthen, and 2000 fishing shallops of 20,000 tons, are usually employed during the fishing season. Twenty thousand men from Great Britain and Ireland are engaged in this trade, and several thousands of them, who remain on the island during the winter, are occupied in repairing or building boats and small vessels, or in erecting the scaffolds for drying the cod. The persons that are not seafaring men have been distinguished by the appellation of planters. Some idea of the value of the Newfoundland cod fishery may be formed, by its being mentioned that the British alone have taken in one year as much as nearly 100,000,000 pounds weight, yielding a gross revenue of at least 2,000,000*l.* sterling.

The fisheries on our own shores do not, and cannot, afford anything like such a revenue as this from foreign trade ; but, from the way in which the northern parts of the island especially are divided by bays, and from the fish surrounding the shores there in almost every direction, the fishing, if properly carried on, would be far more valuable, in a local point of view, than if there were some one fishing ground of much greater extent than even the whole put together. It is to be regretted, however, that this fishery, widely spread as it is, easily as it might be carried on, and inexhaustible as one of the supplies of human life from the vast productive powers of the fish, has never been prosecuted with that skill and industry which its importance demands. We have already said, that there is none of the genus so abundant on the south coast of England as to afford more than a very moderate local supply ; and, though the banks between the shores of England and the Netherlands are frequented by numbers of cod, which grow to a large size, and are understood to be finer in flavour than the east coast ones more northerly, and toward and beyond the middle latitudes of the island, yet it does not appear that anything farther than a local supply can be obtained even there. Toward the land, both on the British and the Netherlands side, the cod-fishing ground is intercepted by water apparently rather shallow for cod, and which is accordingly more occupied by flat fish, by soles perhaps, more than any other species toward the British coast, and by turbot probably toward that of the Netherlands. With the exception of the supply for the London markets, and that is, in a great measure, in the hands of monopolists, the white fishing appears to be sadly neglected on the east coasts of England ; so that it is doubtful whether a single barrel of white fish is salted for foreign sale annually between Dover and Berwick, while the quantity carried into the interior is astonishingly small, considering the extent and rapidity of land-carriage which is now established in every part of the country. This is probably more sincerely to be regretted than it is to be remedied ; but, from the price at which excellent cod is often sold at the coast towns farther to the north, it is extremely probable that proper attention to the fisheries might procure for any man, at any spot within the four seas, a fair-sized cod fish, in good condition, at an average price of not greatly, if at all, exceeding one shilling. The price on the coast, at the places to which we allude,

may be from fourpence to sixpence, when the fish is most plentiful and in best condition ; and surely, if a proper system were established, the same amount might carry it halfway across the island.

On the southern part of the east coast of Scotland, and indeed as far to the northward as the Moray Firth, cod can be regarded as affording no more than a local supply, and that only to a short distance inland, as is the case in the southern part of the island. Cod is not indeed a very favourite fish on that part of the coast. It is said to be of inferior quality to that taken on the banks farther to the south ; and, at all events, it is chiefly bought by the poorer classes of the people, who get it cheaper on the spot, in consequence of its being held in comparatively low estimation ; but this circumstance greatly lessens the inducement to fish for it, and, consequently, the quantity taken. The haddock, another, and, when taken on the proper ground and in prime condition, a far more delicious species, is the favourite white fish on the last-mentioned line of coast ; and so much is it esteemed above every other production of the sea, that even the sole and turbot fisheries, for both of which there are understood to be good grounds in many places, have never been able to create such a demand as to induce the fishers to carry them on expressly, and with a requisite degree of knowledge, experience, and vigour.

This preference may be said to extend nearly the whole way to the north-eastern extremity of Scotland ; for, though cod is caught in considerable abundance, the greater part of it is, we believe, dried, with the exception of what may be consumed in the fishing villages and their immediate neighbourhood. And here, as on the more southerly part of the east coast, the haddock is still the favourite fish for local consumption ; and when we come to notice the characters of that species, we shall probably be able to show that this preference given to it is not a mere prejudice, but that it is really better there than on almost any other part of the British shores. When we come to the Pentland Firth, and to the various bays and banks among the Orkney and Shetland Islands, we have arrived at the grand rendezvous of the northern members of the cod family ; and though the common cod is not the most abundant, or probably the most highly prized in those seas, it is taken in considerable numbers, and exported, cured, or more properly speaking, dried. The fishermen there, being of northern extraction, or descended from the sea-kings of old and their followers, are more adventurous and at home upon the waters than in many other parts of the country. But it is singular enough that they will not bear transportation to other localities ; for colonies of them, which have been carried to the western islands at considerable expense, for the express purpose of establishing fisheries, and teaching and stimulating the natives, have, in the course of a few years, sunk into the same state of indolence and disregard of the vast and almost constant harvest which the sea around them affords. They have, after the lapse of a very few years, lolled indolently on the land, contenting themselves with daily meals of potatoes and salt, and leaving the remains of the boat high and dry, to be beaten and consumed by the wind and rain, while two hours' use of that boat would have provisioned their families for a week, and one good season, duly improved, might have rendered them independent for life. Nor is there any more unfortunate demonstra-

tion of the truth, that men will not exert themselves unless they are pinched, and also stand in some jeopardy of degradation, than the fact that, in many places where the sea is most rich in fish, and they are nearest to the land, the fewest are taken out of it.

As a proof of the advantage that might be derived from those western isles' fishings for cod, we may mention, that the late Sir Hector Mackenzie of Gairloch established at Gairloch, on the west coast of Ross-shire, a fishing village, to which there belonged twenty boats, each having about four hundred hooks on the lines, and that this small fishery produced every year twenty thousand cod fit for exportation, besides an ample supply to the villagers and the neighbourhood from the under-sized cod, and the other fish accidentally taken on the cod-lines. The cod there are rather small in size, averaging about five pounds weight each when they are cleaned, have the heads removed, and are ready for salting. They are, however, of very superior quality—proportionally thicker, firmer in the flesh, and more delicate in the flavour, than Newfoundland cod. Whether this fishery is still carried on, we are not informed ; but, as the adventure was Sir Hector's own, and he was at that time the only proprietor who had spirit enough for such an enterprise, it is possible that even this may now be abandoned. But, when it was in the condition we have mentioned, it was generally understood that, by an additional number of boats, the produce might have been more than doubled ; and thus two hundred thousand pounds weight of excellent fish might, from this little spot alone, have been added to our annual store, while many industrious men and their families might have earned a comfortable living, by winning this treasure from the deep, and adding it to the wealth of the country.

This is one very small and local proof of the great advantage which might be derived from the countless myriads of this species of fish which throng around those remote shores of our island ; and we are within the mark when we say, that the ground alluded to is not anything like a tenth, or even a twentieth, of what might be successfully fished, so that, from the Hebrides alone, we might annually derive not less than two millions of pounds of fish ; and as at those small fisheries, for which salt could be procured at a small expense from Liverpool, by the return of the vessels, the quantity would be superior to that which is obtained at Newfoundland, and would consequently fetch a higher price in the market.

Once, a good many years ago, we observed, on the beach to the northward of the village in the Island of Iona, a pile of dried cod, which must have consisted of many thousands ; but whether the fishing is still carried on there, we have not heard, though we think this rather doubtful, because it was described as being in a languishing and expiring state at that period.

It is true that the winds are both inconstant and turbulent among those western isles, and thus there might be both loss of lines and danger to boats ; but the islanders are hardy boatmen enough, and show no little skill in their craft, as they can guide a little shallop dry through the waves, and so they would not, if they had good craft, run any very imminent hazard. Somehow or other, however, they do not set much value upon the produce of the sea ; and that more than any chance of loss or fear of danger, seems to be the real reason why the fisheries there are not turned to account.

When on their migrations or feeding excursions in the currents, these cod swim near the surface. One can not only see them in crossing the shoal in a boat but they give a whitish tinge to the water at a distance, and seem a sort of "blink" on the sky. One can also find them out by the number of sea-birds—gannets and gulls chiefly—which are whirling about, and screaming on the shore; and ever and anon plunging down; but it is doubtful if they are nearly so successful in cod-fishing as they are with herrings, the shoals of which are still more numerous, swim near the surface, and are more easily taken out of the water. Altogether the shoals of cod give no small interest to the seas, of which we are speaking; and the only regret is, that they should be turned to so little account, in comparison with what might surely be done.

We had almost forgotten to mention that the oil which is obtained from the liver of the cod, answers a very important purpose in the arts. It is valuable as a lamp oil; but that is not its only or its chief value, for there is no oil equal to it for the dressing of leather, for which purpose it is almost exclusively used by the best manufacturers.

THE HADDOCK (*G. æglefinus*). The haddock is a much more handsome fish than the cod; the head and gill openings are not so disproportionally large; and the body is altogether of a finer shape, and the colours brighter. The upper jaw is longer than the under one; the tail is forked; the lateral line is black; and there is a black spot on each side, behind the pectorals, which the legend says are the marks of the thumbs of St. Peter, when he took the tribute money out of its mouth, which shows that the founder of the legend could have known nothing of the geography of the fish. The colour of the upper part of the haddock is dusky, and that of the belly pure white. The frontal line slopes, and the eyes are large and bright. The fins are the same in number, character, and arrangement, as those of the cod; but the extremity of the caudal fin is forked, and the whole air and appearance of the fish are different. The haddock is also a much smaller fish; the cod measuring, when full-grown, or at least understood to be so—for the full growth of a fish is a very indeterminate matter—as much as three feet, while the haddock is seldom found of above half that length. The quantities of matter in them are nearly in the proportions of the cubes of the lengths; but the head of the cod occupies so much of its volume, that there seems to be proportionally more flesh on a well-grown haddock than on a cod of the same length. The spawning time is in spring, as well as that of the cod; but the haddock, perhaps, comes into season earlier than the other. On those shores where this fish is best and most esteemed, it comes into season on the usual grounds in May, and continues till the middle or end of January. There is some reason, however, to doubt whether the same individuals spawn every year; for it has been ascertained by actual trial that, by going a few miles farther to seaward than the annual fishing grounds, haddocks in good condition may be found in April, or, perhaps, even in March. We want more information as to the retreats of our white fish, and whether we could or could not obtain a supply in good condition, all the year round, by a judicious shifting of the ground.—There is another thing to be attended to, and that is the length of time over which the spawning extends, which is probably a much longer one than we gene-

rally suppose; and thus those which have spawned in the early part of the season, may have retired and got into good condition again before the others have got through that grand labour of the year.

Haddocks are certainly found in finest condition in the clear and deep water off the rocky shores; and it is worthy of remark, that they appear to be best in the places of any eastern sea which are intermediate between those in which the cod are best. We have already mentioned that the cod, on the southern banks between the shores of England and the Netherlands, and those, again, about the north-east of Scotland, on the coast of Caithness, are better than on the shores of the middle of the island. Haddocks are good upon all the coast from the rocky parts of Yorkshire to the Ord of Caithness, and a little beyond; but they are very superior upon a certain intermediate portion, namely, on that which extends from the Red Head, a little to the north of Arbroath, to the mouth of the Dee at Aberdeen, where the bold rocky shore and the deep and clear water terminate. On the most bold and rocky portions of this shore they are better than on the others, and they are also got nearer to the land than when the shores are of a tamer character. The east coast of the county of Fife is not high, but it is rocky, and they are pretty good there; and so are they off the wild and caverned shores near the Red Head. The coast of Kincardineshire, which is all bold, with the exception of clear, sandy, or pebbly beaches in the bottoms of a few small bays, is perhaps the place where they are found in the very highest perfection.

This is the part of the coast where the partially roasted and partially smoke-dried ones, known by the name of "Finnin Haddocks," are prepared in the best style, partly because the fish themselves appear to be finer than they are anywhere else, partly because they can be prepared in a more recent state, and partly because the people have a superior method of preparing them. To have them in the highest perfection, however, they must be eaten on the spot, and before they are cooled after the original preparation, for those very superior ones cannot be removed to any distance without losing much of their flavour, and those which can bear carriage have to be salted and much more dried, both of which operations spoil their flavour.

If they are to be of the finest zest possible—and when they are, it is difficult to imagine anything more delicious—they must be brought from the sea the same morning they are to be eaten. Small ones should be selected, if sufficiently plump and well-grown, and the flesh should be touched as little as possible. Indeed, a haddock, under all circumstances, is a delicate fish, and cannot bear to be tumbled about, or handled, or sluiced with water, without sustaining very serious injury, which, by the way, may be one of the reasons why it is difficult, if not impossible, to get anything like a good haddock in London.

Holding them by the head, they should be cut open, and wiped clean by gentle pressure, but not washed; and when they are split so as to be flat, they should be suspended on wooden spits from the top of a cask, of which both the ends are taken out, and the cask so built in at the side of the kitchen range, or in any other convenient place, so that there may be room for a fire below. The best wood for the fire is the twigs of juniper; and the smoke and

heat should be received into the cask, a cloth being placed on the top to confine both; but the flame ought not to rise so as to scorch them. In this way they should be done slowly, and the action of the smoke so hardens the surface, that not a drop of the juice escapes. When properly done, the knowledge of which is a matter of experience, and cannot be explained in words, they are to be removed from the cask, the heads separated without touching the bodies, and these rolled up closely in clean cloths, only one in a cloth, great care to be taken not to press or break them, and they ought to be eaten while hot. The spurious ones, which are sent to a distance, are more or less salted, and exposed to the air, and they are merely smoked, without being cooked, as is the case with those that are genuine. These last can of course be obtained only at very particular parts of the coast; and of those places where the fish themselves can be had, there are only a few where the art of dressing them in the best style is known.

Like the cod, the haddock is a gregarious fish, and if the fishermen find any upon a particular fishing ground, they in general make sure of finding numbers. They are, however, much more discursive and capricious than cod, and by no means so true to their grounds for a succession of seasons; though they are understood to be much more true to the haunts in the clear and deep water near the shores, than they are upon the margins of the out-at-sea banks, where their pastures border on those of the cod. The reason of the two not being found in abundance in the same localities is understood to be that the cod prey upon the haddocks, which is not at all unlikely, as cod are exceedingly voracious, have a very capacious swallow, and are miscellaneous in their eating even to the degree of preying upon each other. We need not be surprised at this, however; for the males of many of the mammalia are prone to devour the young, nor are there wanting among them instances in which the female makes a meal of her own offspring. The haddock is not quite so voracious as the cod; but still it has not much to boast of on the score of abstemiousness.

THE TORSK (*G. callarias*) is a medium sized species, a native of the northern seas, and found most abundantly in the Baltic, especially near the mouths of the great rivers. It is spotted all over, and is very much esteemed for the table. It has been mentioned as a British fish; but the fact of its being so is a little doubtful, at least no specimen has, so far as we know, been seen of late years, or indeed since the species of fishes were so well made out, and discriminated as they are now. The fact of its being found at the mouths of the rivers in the Baltic, where the water contains very little salt, is rather against its being met with in the open ocean, or in any part of the British seas, except as an accidental stray.

THE BIB (*G. luscus*) is a small species, not more than a foot in length, which is occasionally met with in the British seas, but is by no means common, nor does it appear to be abundant or of frequent occurrence in any locality. When it does occur as a British species, it is, however, found indiscriminately on the most northerly and the most southerly shores. Its colour is olive on the back and silvery on the under part. The first ray of each ventral fin is produced in a sort of bristle-shaped elongation. The body is broad but flattened on the sides; the ex-

trinity of the caudal fin is nearly square across; there is a membrane which partially covers the eyes; the jaws have only a single row of teeth curved inwards into the mouth; and the scales are larger than on most of the genus. Its flesh is reckoned wholesome, and good; but so little is known of its manners that we are unable to say whether it is or is not gregarious.

THE POUL (*G. barbatus*) is about the same size as the last mentioned species, and like that it is rare on the British coasts; but in appearance and colour it is different. Its back is much arched and the whole body high in proportion to the thickness. Its general colour is dull white, with the fins black, and a dark spot behind the pectoral fins. The first dorsal fin is of a three-cornered shape, with the first ray produced in a sort of fibrous appendage; and the caudal fin is squared over at the end. The scales on the body are very small; the back is furnished with a sort of keel or ridge; the lateral line is broad, curved, and of a white colour. The mouth is much smaller in proportion to the size of the fish than in most others of the genus; and the lower jaw is marked with a row of punctures, seven or eight in number. The English fishermen call it the "whiting pout." It is but little esteemed as food, and probably upon this account it is not seen in proportion to the numbers in which it actually exists. It occurs in the Mediterranean, and also in the more northerly seas; and is understood to inhabit at considerable depths, and to hide itself in the thick beds of sea-weeds.

THE POOR (*G. minutus*) is a small species, about half a foot in length, and very slender in the body; light brown on the upper part, and whitish on the under. The lateral line is very narrow and straight. It is found in the Gulf of Venice, the Mediterranean, and the Atlantic, where it resides in the deep waters during the winter months, but comes to the shores in the spring. In itself it is of little or no value; but its appearance is, on some of the coasts, hailed with joy by the fishermen, who, upon its coming, prepare for the capture of the larger and more valuable species of the genus, which appear soon after it, and appear to follow it and feed upon it, which brings them near to the land.

The species which we have now enumerated are the principal and most valuable of those which constitute the sub-genus *Cod*, properly so called, with those systematists who sub-divide the family into sections; and the sub-genus is styled *Morhua*, from the trivial name of the common cod. We shall now proceed to the other sections, still retaining the common generic name *Gadus*, as the family are all nearly allied to each other.

But before we do this there are a few observations in supplement to this division which may not be uninteresting to the reader, some of which refer to the common cod, and others to this division or to the family generally; and the great value of these fishes renders every thing that can tend to illustrate their character of considerable public interest.

Of the *common cod*, there appear to be three varieties in the British seas; but whether the differences have or have not been wholly produced by locality and nature of ground, we have not the means of ascertaining. The southern cod, that which is found on the banks off the English coast from the Spurn to Kent, and which also occurs in the English Channel, though not so abundantly, appears to

be resident in those seas, and is very rare in the north. It is more of a yellowish colour than that of the northern cod, its head is smaller and longer, and it perhaps also attains a larger size. On the banks we believe it is always taken by the hook and line; but in the Channel it is hauled for.

On the rocky grounds in the middle latitudes on the east side of the island, and probably also on the west, in the channel between Britain and Ireland, there is another variety, known as "rock cod," which is of a much redder colour, smaller in size, and much firmer in flesh. This one frequents much the beds of sea weed, and is understood to feed a good deal upon crustacea, especially crabs at the time when they cast their shells. The head of this is not quite so much elongated as that of what we have from its locality called the southern cod, but it is rather more so than the head of the northern. It does not appear that this variety is very discursive from its locality; for though it can be had abundantly on the rocky bottoms on the northern part of the English coast, and the southern part of the Scottish, it is found only as a straggler in the south; and we believe that the same is the case in the north. In as far as popular observation is concerned, these two varieties are easily distinguished from each other; but they agree in all the characters upon which naturalists found the species.

The third is the northern cod, and which is sometimes called "Scotch cod," it being most plentiful on the coast of Scotland, though, as we have mentioned, the rock or red cod is also found there, and this one occurs on the more northerly parts of the English coast. This one has the head much larger in proportion, that is to say, much thicker and rounder; the gape and the gill-openings are also wider, and the body tapers nearly the whole way from the gill-openings to the caudal fin. This is the one which is found both on the east and west coasts of Scotland. It appears to be more discursive than the others; and it is probably the same which is met with on the bank of Newfoundland, and generally in the Atlantic outside the British islands. Its quality is understood to depend a good deal on the place where it is taken, being best where the water is deepest and has most current, though the size is perhaps inferior there. Even in this, however, there is no specific difference from the others; and from what we know of the effects of different waters in changing the qualities of trout, and other fresh water fishes, we may naturally suppose that not cod only but all others will be affected by similar causes in the sea.

The other point to which we would call attention, and it is by far the more important of the two in a general point of view, is the geographical distribution; not only the cod, properly so called, but all the more valuable species of the whole genus, are confined to the temperate and cold latitudes of the Atlantic. The same may be said of the herring family, and indeed of all those fishes which have value in a commercial point of view, or in any other point of view than that of merely supplying the people who live near the shores.

The only species, we believe, which is met with in any part of the Pacific is the coal-fish, to be afterwards described, and though it is exceedingly numerous upon many parts of our coasts in the young state, and especially so in the north when full-grown, it is far from being the best of the genus; so far indeed

that, in point of flavour and also of nutriment, it may probably be accounted the very worst of the whole.

The fishes of this family, besides being inferior in their qualities, are also far more prolific than any others; and as they are, either seasonally or in the different species, both *littoral* and *pelagic*, they occupy a greater breadth of sea as their pasture than any others. The common cod has been already mentioned as an instance of very great productiveness, but it is by no means the most productive of the family. The ling, a more northerly fish, and one which is in some respects superior, very superior when salted and dried, has still more eggs in the roe than the cod, the number being between nine and ten millions, a rate of increase on which all the fishing that can be practised cannot have the slightest perceptible effect; for, if it had scope for full working, it has power enough for turning the whole matter of the earth into ling in the course of a very short period of years. This is of course, practically speaking, impossible, but still the power exists, and the existence of such a power is constantly seen working for the benefit of man, in so far as he has industry and skill for taking advantage of it.

One cannot fail in being struck with the peculiar fact that all this vast productiveness of food in the sea should be concentrated into the northern part of the Atlantic; for the vast shoals of the cod family, and we may add those of the herrings, are confined to between the fortieth and sixtieth degrees of north latitude, or are found only accidentally and straggling beyond those limits.

This, however, is not the only or even the especial peculiarity of this portion of the sea; for, though it is foreign to our present purpose, we may just remark in passing that the Atlantic is, above all others, the ocean whose showers and gales produce fertility on the adjoining lands. It is especially the ocean of tides and currents; its shores abound more than any others in creeks and bays; and the quantity of supply which it receives from rivers is greater than that of any equal extent of sea, scarcely less indeed than that of all the other seas on the surface of the globe. It is thus the best for navigation, and the promotion of that intelligence and industry which are the results of a free, easy, and speedy communication between the inhabitants of different lands. This is a very delightful subject; but it would be contrary to the plan of the present work to enter farther upon it in detail, though we heartily recommend it to the attention of our readers, and so revert to our more immediate subject.

If we were to follow the sub-divisions of the genus *Gadus*, the next is *Merlangus*, the whiting section, agreeing with the cod in the number and arrangement of their fins, and differing, in the common characters of classification, only in having no beard or fleshy appendage to the lower jaw, whereas the true cod have one, and some of the others, to be mentioned afterwards, have more. The typical species is,

THE WHITING (*G. merlangus*). This is a very common species on most parts of the British shores; and by fishing nearer the shores at one season, and farther out at another, it may, generally speaking, be caught in tolerable condition the whole year round. It is a smaller fish than the more valuable of the true cod, and its flesh is, generally speaking, soft and rather insipid; but when in very prime condition, which it is in the spring and summer months, it is

esteemed as light and delicate. Like all other fishes, the whiting varies much in length, but the average is about a foot. The upper jaw is the longest, and the teeth in that jaw are long. The colour on the upper part is pale brown; the sides and belly are silvery, more or less marked with pale yellow; and the lateral line is straight and white. The whole fish has a rather delicate and semi-transparent appearance.

The whiting does not perhaps range so far to seaward at any season as some others of the genus. In the summer months, at least, it remains much closer in than the others, feeding on the fry of herrings and other fishes which deposit their spawn near the shore; it also feeds on crustacea and mollusca. Indeed, though the whiting is a delicate fish to appearance, it partakes of the voracity and miscellaneous feeding which are characters of the whole tribe. Different from what is the case with most of the others, the whiting is understood to be fattest and in best condition upon the flat shores and rich bottoms, though its flesh is said to be firmer when it inhabits the rocky grounds. Whiting, though far from being so substantial as an article of food as many of the others, is understood to be more light and easy of digestion, more so indeed than perhaps any other fish; and thus it is an aliment well adapted for invalids. Whiting is generally eaten fresh; but it is also salted, though it does not answer quite so well for that purpose as those species which have firmer flesh.

THE COAL-FISH (*G. carbonarius*). This is a very common species, found upon most parts of the British shores, though much more rarely on the southern than the northern. It is a very active fish, and found most abundantly in rocky places, or in currents and tideways. When young it occurs in vast shoals at the entrances of harbours, and in all places where there are runs of water near the land; in which places vast numbers are caught, with rod and line, by the boys and idlers, but they are of no great value. In this state it is small, not in general larger than a sprat, and by no means so well flavoured as sprats are when they are newly taken, but it can be longer kept. In this state it is the "podlie" of the Scotch coasts, the fishing for which, at the ends of the piers and jetties of harbours, is reckoned the most inglorious of all fishing. In this young state the upper part is dusky, and the under part dull white; but the colours of the full-grown fish are different.

When full-grown it reaches the length of two or even three feet. The upper part, including the caudal fin, is then black, but dull and with a tinge of leaden blue toward the sides. The under part, including the ventral and anal fins, is white; the head is small, and the form of the body rather elongated. The tail is very broad and forked, and the fish keeps the water which is put in motion by the tide or otherwise, and swims with much vigour and rapidity. In this state, as well as when young, these fishes take the bait very greedily, and thus are more easily caught than almost any others; but they are tough and leathery, so that they are nowhere very marketable. They are, however, used both in the recent state and salted; and from their cheapness, they are eaten in great numbers by the labouring people on the poorer islands and parts of the coast. The Shetland isles are their head-quarters, in so far as the British dominions are concerned; and so numerous are they on the coasts of Scotland and its islands, that they have about a dozen local names in different parts. In the

Shetland isles they are called piltocks, and as the cows are said to eat herrings on some parts of these islands, so the poor people very generally, and at all meals, eat piltocks. It is reported that a traveller in those isles, meeting a boy in the forenoon, and not getting a very ready or clear answer to some other questions, asked him what he had had for breakfast that morning. "Piltocks," was the immediate answer. "What do you expect for dinner?" asked the traveller. "Piltocks." "And what for supper?" "What could any body get at our time but piltocks?" This is the species which is mentioned as being numerous on the northern shores of the Pacific; but we believe that specimens brought from there have not been very carefully examined in Europe.

THE POLLACK (*G. pollachius*) does not grow to the same size as the coal-fish; and is not found in places of exactly the same character; but still it is very common on the rocky parts of the coasts. As is the case in the coal-fish, the lower jaw is longest. The eyes are large, the irides of a brown colour, the upper part is dusky green, the sides marked with yellowish streaks, and the belly white; the line of the back slopes from the first dorsal fin; and the tail is squared over. The average length when full grown is understood to be about a foot and a half. These are very active fishes, and sport about in the utmost violence of the sea. They are often found in vast shoals, and are easily taken; but their flesh is not held in much estimation, excepting where the better species are not to be had.

THE GREEN POLLACK (*G. vireus*). This species is by no means uncommon in the larger tidal estuaries of the northern parts of Britain, and it is frequently caught but not much valued. It is more abundant, and more attended to on the coasts of Norway. The upper part and upper fins are green, and the under part white, the fins being marked with numerous black spots. The teeth in the upper jaw are numerous, and very strong in proportion to the size of the fish which, on the British shores at least, is rarely if ever so much as a foot.

These are the principal species of that section or sub-genus, of which the whiting is considered the type; and, taking them altogether, they are of far less value in an economical point of view than the former, or than many of those that remain still to be noticed. They are, perhaps, more active than any of the others, and they come in greater numbers near the shores, and into the tideways, and are much more easily caught. The next division is that of which the common hake is the only known species; and, from the trivial name of that, the division is called *Merluccius*; the distinguishing character is having only one anal fin.

THE HAKE (*G. merluccius*). This is a much more southerly species than most of the genus; and is mentioned by Cammeron as abounding in the southern hemisphere. It is also met with in the Mediterranean more plentifully, perhaps, than any of the others. On the coasts of Scotland, especially the east coast, it is very rare; it is less so among the more southern of the western isles, and also on the south coast of England. But the west coast of Ireland is the part of the British dominions where it is most plentiful, especially the coasts of Mayo and Galway. It is an active fish, ranging and disjunctive, and thus appearing only seasonally on the coasts; but it is gregarious, and when it does appear on its regular grounds, and

not merely as a stray, it appears in great numbers.—It is at all times rather a harsh fish, and when not in good condition it is peculiarly tough and dry. It is best when salted and dried; but even then it is hard, and requires to be beaten to a sort of fibrous powder before it is dressed. It is a large fish, very often caught of the length of three feet or more.

The next division is that of which the ling is the type; and, from the trivial name of that fish, the division is styled *Molva*, or sometimes *Lota*, after the burbot. The leading three characters are—the head flattened; the body elongated; the second dorsal and anal fin long, and their rays of nearly equal length.

THE LING (*G. molva*), has the body long in proportion to the diameter, but very plump and compact in flesh. The upper jaw is longer than the under; the caudal fin is rounded at the extremity, and marked with a dusky bar. In the characters of all this division, there is, indeed, a slight approximation to those of the eels. The upper part of the ling is olive grey, and the under part white, which is also the colour of a narrow margin on the dorsal and anal fins.

The ling spawns in spring, at the same time with the cod, so that the two are in season together. Indeed, they inhabit nearly the same parts of the sea, only the ling is rather the more northerly fish of the two. On the north coasts of Scotland, and among the northern isles, it is equally numerous with the cod, if not more so; but southwards it is rather more rare; and rarer still toward the south of England. It does not appear that there is any southern variety, or, indeed, any variety at all of the ling, as there is of the cod; and, therefore, we know it chiefly as a northern fish. It is, as has been already remarked, among the most prolific of all fishes, and it has been observed of fishes of the same family, that those which have the body most elongated, are in general the most prolific. In those seas where it is found, the ling is taken for a supply of fresh provision as well as for salting; but as it is the most marketable of all the salted and dried fish of large size, which are prepared in the north of Scotland and the northern isles, it is chiefly salted and dried there, the process being frequently no more than spreading the split fish upon the rocks, and watering them from the sea. It attains a larger size than the cod, though it is not so thick at the anterior part. From three to four feet is the usual length of ordinary sized ling, but specimens five feet in length are not uncommon. The summer is the fishing time; and when the liver of the fish is white, the fish itself may be considered as in condition; but if the liver is coloured, it is not wholesome. The liver of the ling gives an oil similar to that of the cod, and applicable to the same purposes; indeed, it is probably finer and more transparent. Altogether the ling is one of the most interesting and valuable fishes in those seas which it inhabits, and it is quite a treasure to the northern people.

BURBOT (*G. lota*). The jaws in this species are of equal length, and the caudal fin is oval, and even a little pointed at the termination, something approaching in shape to that of an eel. The length varies from one foot to three, and upwards; the ground colour is brownish, with blotches of pale yellow and olive. The first dorsal fin is short, and consists of eleven rays; the second fin extends along the back, almost to the caudal fin, which is another approximation to the eel family. It is a river fish, and not a sea one; and as a British fish it has been found in the slow

rivers of the rich parts of England only. Different from those which inhabit the sea, it spawns about the middle of winter; and it differs from the eels in spawning in the cold season, and not descending the rivers, so far as has been ascertained, for the purpose of maturing its spawn. The common English name "burbot" is a contraction of "bird-bolt" a kind of short arrow shot from a cross-bow, which this fish is understood to resemble in shape, and after which it has accordingly been called. It is also named the "eel-pout," and the "coney-fish." It is understood to lie in watch for its prey, agitating the barbels on its mouth, as if they were moving to attract the small fishes upon which it preys; and when they come within its reach they are seized and swallowed. Its gape is large, and it is furnished with seven rows of teeth, so that there is little chance of escape for any thing that once gets within its jaws. Its body has the same slippery covering as that of the eels, so that though taken in the hand, the hold of it is not easily retained. Its flesh is very white, and much prized for its flavour; but the roe, the individual eggs of which are very large, are understood to be unwholesome, and difficult of digestion. It is furnished with a very large air-bag. On the continent it is found much more abundantly than in Britain, and it also occurs farther to the north, being known in Sweden and Norway, while in the more sluggish-currented of the German rivers it is very abundant. It is a singular fish: the general organisation is decidedly that of the cod family; but the form, some parts of the organisation, and also both the habits and the locality, approach to those both of the eels and the blennies. It may be considered as among the most anomalous of all the British fishes.

The next division are the Gades, of which the trivial name of the common gade, *Mustela*, has been taken for the sub-generic name by many, and the name *Gadus* by others. In the south of Scotland the common pike is called the "ged," but it must not be confounded with the gades of the cod family. The characters are—the first dorsal fin very small, and the head of moderate size. There are several species which come under this division.

FIVE BANDED GADE (*G. mustela*). This species has, as the trivial name imports, five filaments or bands on the anterior part of the head. Of these four are on the upper jaw, and one on the under. Two of the upper ones are on the fore part of the mouth, and the other two immediately over them. The remaining one is on the middle of the lower jaw, similar to that in the common cod. It is a sea fish, found on the coasts both of England and of Scotland, but more frequently on the former, where it is called the "sea-loche," the "whistle fish," and the "rockling," the last of which names points out the kind of ground on which it is most common. It also occurs on the coasts of Germany, and in the Mediterranean. It is about a foot and a half in length, generally olive above, and whitish on the under side; but its colours are subject to considerable variations, and it is often found spotted, and sometimes nearly white all over. It is chiefly found among the seaweed about rocks, where it feeds on crustacea and mollusca.

THREE BANDED GADE (*G. tricirratus*). This species is about the same size with the former, but, as the name implies, it has only three appendages, one of which is on the lower jaw, and two on the upper. Its colour is also different; and all the rays of the

dorsal fin are short, while in the five-banded species, the first one is long. The young fish is reddish brown, but after it grows the length of seven or eight inches it becomes reddish yellow, with large dusky spots. It is, perhaps, more common on the British shores than the former; but its haunts and manners are similar, and some regard it only as a variety.

SILVERY GADE (*G. argentarius*). This species has been but little noticed, and in Britain only on the south coast. Its manners are accordingly very little known. The specimens which have been met with have been very small, not exceeding two inches in length; and the colours were bluish green on the upper part, and silvery on the under. It may possibly be the fry of the five banded gade; and indeed there is some obscurity about the species or varieties which come under this division. They are, however, of little importance for popular purposes, as none of this division of the genus are of much value, and it would be inconsistent with our plan to go into the niceties of museum specimens.

The next division of the genus is that of which the tusk is the type; and, from its trivial name, the division is called *Brasmus*. Some of the species are a little confined and obscure, but others are well made out, and of much interest and value.

THE TUSK, OR COMMON TUSK (*Brasmus*). This species must not be confounded with the *torsk*, which is a spotted variety of the common cod, having the same arrangement of fins, one-barred on the lower jaw, and all the characters of the common cod, except being spotted with brown, which the common cod is not, though often with dull yellow. As a British fish, the tusk is chiefly found in the most northerly seas, where it attains the length of about two feet. It is a bank fish, and caught in the same places as the common cod and the ling, the last of which it most nearly resembles in flesh. As is the case with ling, it is not so much relished in the recent state as cod, but, when salted and dried, it is a very superior fish, and tusk and ling are often associated together. It has the small dorsal and the anal fin lengthened, the ventral fins fleshy, the pectorals and caudal rounded at their terminations, and most of the fins margined with white. The colour on the upper part is dusky, that on the sides yellowish, and that below white. It is one of the most northerly of the whole of the cod family as a British fish; but on the banks among and near the Shetland islands it is far from rare.

Some other species of tusk have been mentioned, as one of a yellowish colour, occurring near Newfoundland, but not common, and another in the Mediterranean, with a single dorsal fin. The first may be merely a coloured variety of the tusk of the north, and the other seems to be somewhat doubtful; at least, it would be rather singular to find in the Mediterranean a fish which is known only in the extreme north even as British. This, however, is not a point for popular discussion.

Another division is named from the fork-head, the trivial name of which, *Phycis*, is used as the general name of the division. The species are somewhat involved in obscurity.

THE COMMON FORK-HEAD (*G. phycis*) is a species occasionally met with on the south-west coast of England, but it is rather of rare occurrence. It is usually found about a foot in length; it has large eyes, with white irides; the first dorsal fin is trian-

gular, with the first ray produced; the ventral fins are twice the length of the head, placed far forward on the throat, and each consisting of a single ray, forked, or divided into two braches. The lateral line is curved, and the extremity of the tail rounded. The head is very large. The one now mentioned appears to be a southern fish, and is not met with on any of the northerly coasts of Britain. There are some others, which have been confounded with the hake, and also with the blennies. One, the *Phico* of the Italians, occurs in the Mediterranean, and on the west coast of Spain, and an occasional stray appears on the south coast of England. The head and pectoral fins are red in the spring months.

THE THREE-FORKED HAKE, of British authors (*Raniceps trifurcatus*), has the head flat, the mouth wide, the first dorsal fin very obscure, and is said to be about two inches in length. Little is known respecting it, and it does not appear to be a fish of very much interest.

The genus which Cuvier appends to the cod family, without positively including them in it, are the Grenadiers (*Macrourus* of Bloch, *Lepedoliprus* of Risso). They have the muzzle depressed, and advanced farther forward than the mouth. The first dorsal high, but short; the second dorsal and the anal long, and joining the caudal. The whole skin is covered with hard scales, armed with spinous processes; and the teeth are very small. It does not appear that these fishes, the history of which is rather obscure, have any very striking resemblance to the more typical members of the cod family. They live in very deep water both in the Atlantic and the Mediterranean, but probably not so far north as even the south coasts of Britain. It is said that they make a sort of growling sound with their gill-covers when taken out of the water.

Such is an outline of this most interesting family of fishes, short and imperfect it must be admitted, but still all that our limits will afford, and, in some of the species, all that we have any data for.

GÆRTNERA (Roxburgh). A genus of climbing plants, natives of India and China, formerly called *Hiptage mandablota* by the botanist whose name they now bear. The flowers are decandrous, and the plants rank in the natural order *Malpighiaceæ*. They flower in our stoves, if allowed room, and are propagated by cuttings.

GALAGO, a genus of mammalia, belonging to the order *Quadrumanæ*, or those which have the four extremities formed for grasping. Arranged by Cuvier in the family of the *Lemuridæ*, or those four-handed animals, which have the cutting teeth in one or other of the jaws different from the apes. The other genus to which they are most nearly allied is that of the *Lovies* or slow lancers; but they differ in many particulars, and they inhabit a different locality. The loves are found only in the south-east of Asia and in the eastern islands, while the galago belong exclusively to Africa and the islands near its eastern shore. We shall, however, save repetition, and place the relations of these animals in a clearer light by considering them along with those other genera in one general article *LEMURIDÆ*, to which accordingly the reader is referred.

GALANTHUS (Linnaeus). The *G. nivalis* is the well-known snow-drop, of which there are only two species. It belongs to the natural order *Amaryllidææ*.

GALATEADÆ (Leach; or more properly **GALATHEIDÆ**). A family of macrourous ten-footed crustacea, nearly allied to the lobster family, distinguished by a broader and flattened form, by the lateral portions of the tail being formed into plates capable of opening and shutting like a fan, and by the spurious condition of the fifth pair of legs; the two anterior legs are large, and often very much flattened; the terminal segment of the tail is bilobed. The species are all marine, and some of them, although belonging to the section *Macroura*, have all the appearance of the crabs or *Brachyura*.

In the typical genus (*Galathea*, Fabricius) the tail is extended, the carapace or shell oval or oblong, rugose, or transversely striated and ciliated; the middle antennæ extended, and the claws are elongated. These crabs, or nocturnal animals, some species residing in rocky situations at a considerable depth, whilst others prefer a flat bottom at an equal depth, where they are found amongst *Algæ*, *Fucus*, &c. M. Risso has published the description of a fossil species found in the excavations near Nice, which he names *Gal. antiqua*. According to M. Bosc, the mode in which the renewing of the shell is effected is very different from that which ordinarily occurs, this author asserting that it is by means of a general dislocation of all the articulations or scales of the body, together with the rapid production of intermediate plates, which become soldered to the old covering, that this is effected. We need only to refer to our article on the Crustacea in general for an account of the ordinary mode in which the moulting of these animals takes place, and which we should conceive, from analogy, must also occur in the genus under consideration.

There are two British species belonging to this genus, the names of which have been much confused by Dr. Leach. The typical species is the *Galathea strigosa* (Fabricius; *Spinigera*, Leach). It is of a red colour, variegated with blue; the rostrum acute, seven-spined; the claws short, spinose, and compressed.

A third British species, *Galathea rugosa* (Fab.), forms the type of Leach's genus *Muneda*. The other genera are *Grimotea*, *Æglea*, *Calypso*, *Pisidia*, and *Porcellana*, the last of which is at once distinguished by the tail, which is folded under the body as in the *Brachyura*; the shell, moreover, is flat and orbicular, or subquadrate, and the claws triangular and nearly flat. The type is the *Cancer platycheles* of Pennant. It is found upon our rocky coasts.

GALATHEA (Lamarck; **VENUS**, Linnæus). This very elegant mollusc inhabits fresh water rivers. Its general character is as follows:—The shell is equivalve, subtriangular, the primary teeth furrowed, two on the right valve, joined at the base, three on the other valve, placed triangularly, the intermediate one being advanced, separate, thick, and callous; the muscular impressions are lateral, and appear double on either side. In its native state this shell is covered with a greenish epidermis, beneath which the surface is of an ivory white, highly polished, and from two to four delicately coloured violet rays, diverging from the apex to the margin, which is also slightly tinged with violet, particularly at those points of continuation of the rays which indicate the local position of the animal's excretory ducts of colouring pigment. In the arrangement of recent malacologists this shell is described as a species of *Cyclas*, to which it certainly

bears a close affinity. It may also claim an union with the genus *Cyrena*, which is now also united to the genus *Cyclas*, the distinctive characters being too finely developed to warrant a separation of the genera. Sowerby has very properly changed the name of this genus to that of *Potamophila*, *Galathea* being the name given by Fabricius (and likewise adopted by Lamarck) to a genus of crustacea. All the species of these molluscs inhabit fresh water, being located in the mud, and consequently but rarely met with in the ordinary course of seeking shells. The greater number are from India. Several fossil species have been described by DeFrance and Brocchi; and Mr. Cumming, by whom malacology is so highly enriched, has discovered several species, hitherto unknown, of this genus and its congeners. In the general system we have adopted as our guide, in order to assume a given arrangement, this genus is classed in the third class *Acephalophora*, third order *Lamellibranchiata*, eighth family *Conchacca*.

GALAXIA (Linnæus). A genus of Cape bulbs, bearing beautiful flowers. They belong to the order *Irideæ*, and are grown in sandy loam and leaf mould, kept dry when torpid, and watered only when they are growing. They are usually kept in a frame, or in the greenhouse.

GALBANUM is the *Bubon galbanum* of Willdenow, a Cape of Good Hope shrub, which yields a gum much used in medicine.

GALE, or **SWEET GALE**, is the *Myrica gale* of Linnæus, a plant common in the northern bogs of Britain and Ireland, valued for its fine scent.

GALEOBDOLON (Smith), *G. luteum*, is the yellow dead nettle of English botany, a weed common in moist shady places. It belongs to *Labiata*.

GALEODES (Olivier—**SOLPUGA**, Lichtenstein), a remarkable genus of arachnidous animals, forming the type of a distinct family *Galeodidæ* or *Solpugidæ*, in the order *Adelarthrosomata*, having somewhat the appearance of large spiders, but possessing a pair of large compressed claws attached in front of the mouth having the finger moveable. The palpi are large, and resemble antennæ or legs, the eyes are attached in front of the thorax, and the abdomen, which is fleshy and very hairy, is composed of nine joints. The palpi are furnished with a small organ of a whitish colour, which is only exerted when the animal is irritated. They run with great rapidity, throwing up the head in an attitude of defence when attacked, and are reputed venomous, whence the name of the typical species, *fatalis* (Fabricius). With the exception of a species found near Havanah by M. Poey, the species of this genus inhabit the hot sandy countries of the old world. Figures of some of the Egyptian species with anatomical details, are represented with the highest degree of accuracy in the great work upon Egypt, undertaken by order of Bonaparte.

GALEOLARIA (Lamarck). This genus of molluscs nearly approximate to the *Vermilia*, but the size of the shell, the peculiar structure of the aperture, and, more especially, the extraordinary operculum have induced Lamarck to constitute the present genus. Their tubes are found adhering together at the base in crowded groups or tufts, open at the summits; the aperture is orbicular, terminating on one side in a spatulous tongue (*lingulam spatulatum*); the operculum is squamose, furnished on the upper side with small testaceous pieces or valves, from five to nine in number, the middle one dentated at the

truncated part of its summit, the others a little toothed on their internal margin ; the whole of them attached to the edge of the operculum on one side only.

GALEOMMA (Daudin). This shell is found in the British Channel, and one species described by Turton. It is equivalve, inequilateral, transverse, with the front margin gaping in an oval form ; the hinge without teeth, and the ligament internal.

GALEOPITHECUS—Flying cat. A genus of Cuvier's order *Carnassier*, and the division *Cheiroptera* of that order, which division comprises only the present genus or family, and the far more numerous one of the bats. The epithet "flying cat," as applied to these animals is of course absurd, and so is "flying lemur," which has also been given to them.

As little can these animals be classed as having much resemblance to the bats, either in their external structure or in the form and arrangement of their teeth. In the bats, the toes of the fore feet are very much produced ; the flying membrane is expanded on them, and there are large pectoral muscles which give them motion in the air, very inferior to that of a bird, no doubt, but still bearing a slight resemblance to it. In the animals of the present genus, on the other hand, the toes of the fore feet are not more produced than those of the hind ones ; the membranes are not properly flying membranes, and there are no pectoral muscles by means of which the animals can take a stroke in the air so as to have continuous flight. In bats, though the flying membrane is often so far continued on the upper part of the hind legs, the hind feet are always free ; but in the genus *galeopithecus*, the hind feet are as much connected with the membrane as the fore ones, and the intervals of the toes are webbed by a continuation of similar membrane. In the anterior part of the membrane there is also considerable difference. The head is always free in the bats, and so is the greater part of the neck. But in the present genus, the membrane extends as far forward on both sides of the head as the jaw, or even the gape. There is thus absolutely too much of the membrane for the purposes of flight—the animals are so entangled in it that they cannot by possibility fly, or take one stroke in the air with the membranes. They are thus not flying animals at all ; and the membranes can answer no other purpose than that of a parachute to bring them up when they leap farther than their weight could otherwise be supported. Their whole motion cannot, however, be derived from the leap, which is at first taken from a solid point of support, and they can gain no new impetus till they alight on a second support and leap again.

From the way in which they are entangled in the membrane, it is also obvious that, while it is extended they can make no use of any part of their bodies, further than merely opening and shutting the mouth.

Any one who is in the least acquainted with the principles of animal mechanics, must at once see all this. There is no wing, or fin, or foot, or any other organ for motion of any animal, which has bones attached to pieces of the skeleton, or of the membranes to which the organs of motion are articulated at a distance from each other. There may be many bones from different parts of the body to support the point to which the organ of motion is articulated, some very fine, instances of which will be found noticed in the article BIRD, and there may be any number and

arrangement of the bones in the moving part, further away from the body than this point. But the primary articulation of the organ, is always one single attachment, and the proximal part of it a single bone ; and if the motion is to be a powerful one, the head of that bone is always a *trochanter*, and the joint a single ball and socket joint. There is no exception to this in any one organ of motion in the whole animal kingdom in cases where the organs are supported by bones, which is the case in all the vertebrated animals ; and it would be just as impossible for an animal to move with its fore and hind legs tied together with natural membranes, as if they were tied with ropes. In the case of the bats, the hind legs have no motion in flight ; for the whole of the flying membrane is put in motion on the shoulder-joint, and the only use of the hind leg in those which have the membrane extended to it, is to act as a point of support and rest. As little could these animals use the neck, by bending it in any one way which the membranes are stretched ; for these brace it with equal firmness on both sides, and hold it tightly in the same position, just as the shrouds on the two sides hold the mast of a vessel. Every animal which can really fly, that is, which can take a new impulse from the air as a fulcrum, has its head, and its feet, if it has feet in addition to the organs of flight, which is generally the case, free when it flies, otherwise it would be helpless and imperfect. The same observations which have now been made apply to what are called flying squirrels, to the marsupial animals of Australia which have extended membranes, and to every animal which stretches a membrane by means of two feet on each side. Not one of them can fly ; and therefore the application of the epithet flying to them is improper, as tending to mislead the ignorant.

The teeth of the *Galeopithec*i, are as peculiar as their membranes,—their mouths being the most completely insectivorous of any in the whole class of mammalia. Their cheek teeth are all tuberculated in their crowns. Their canine teeth are no higher than the cheek teeth, and they are tuberculated. They have two front teeth in the upper jaw, which are also tuberculated ; and they have six fore teeth in the under jaw which are formed something like combs.

These animals are found only in the islands on the south-east of Asia, where they inhabit trees, and are rarely, if ever found on the ground. One principal part of their food is insects, of which, from the structure of their teeth there can be little doubt ; another is said to be the leaves of the forest trees ; and in the case of the succulent ones, this is by no means unlikely. It is, however, added by some describers that they eat birds ; but this is by no means so probable,—we are not acquainted with any bird-eating mammalia, which have not canine teeth adapted for wounding, and also something in a more rearward part of the jaw which may be considered as a carnivorous tooth, of some kind or other.

These animals have five toes on each of the feet ; the fore and hind feet are formed very like each other ; and all the toes are articulated in the same plane, so that none of them acts against the other, or has the least resemblance to a thumb. The feet are turned laterally, and by no means adapted for walking ; and, as is the case with the sloths, their most powerful action is inwards, especially of the hind feet. They can hang suspended by these feet to a

branch ; but enough of attention has not been paid to their anatomy for enabling us to ascertain whether this is done wholly by muscular effort, or whether it in part depends on an elastic ligament. They leap from tree to tree, or at least from one branch to another ; and the females—which have pectoral mammæ, carry the young partly in the membrane and partly embraced by one fore leg.

There are several museum species ; but there is not more than one real one very clearly made out. It is about the size of a cat, reddish grey on the upper part and reddish on the under ; but it is understood that the young are differently coloured from the old ones, and that they go through several differences of colour before they arrive at their full growth. They are found in the Philippines, the Pelew islands, and various other groups in the eastern seas ; but it does not appear that they occur on the main land of Asia. They are said to have a strong and unpleasant odour ; but the islanders where they are found seek after them with avidity, and eat their flesh with considerable zest. They are different in many respects from all other known animals, and not the least singular part of their history is that they are confined to so very limited a locality ; and that we have no reason to suppose that they are in any way a remnant of a race which had once been more widely distributed and consisted of more species ; for the islands which they inhabit cannot be regarded as remains of a former continent ; but are rather independent formations of more recent date than even the continent of Asia. We want more information respecting them for any thing like scientific detail.

GALERUCIDÆ, a family of herbivorous beetles belonging to the section *Tetramera*, and sub-section *Cyclica* of Latreille, and nearly allied to the *Chrysomelida* (which see, for general observations on those groups), but distinguished by having the antennæ inserted close together, and exposed at the base, the joints being sub-cylindrical, with the terminal ones generally somewhat thickened ; the body is oval, or rounded, and the palpi have the terminal joint more or less conical. These insects, which are generally of a small, or but of moderate size, are herbivorous in their larva and perfect state ; the typical species seem to prefer aquatic plants, and herbs growing in damp situations, upon which we have found some of the larvæ ; whilst others are found upon plants in hedges and fields, especially preferring the *Cruciata*. The genera are *Adorium*, *Adimonia*, *Auchenia*, *Luperus*, *Calomicrus*, *Galeruca*, and *Haltica*, with the numerous sub-generic divisions of the latter genus, which comprises the troublesome turnip-fly (*Haltica nemorum*). (See HALTICA.) The typical genus *Galeruca* (Geoffroy), comprises those species which have the legs of equal size, the hinder pair not being formed for leaping ; the antennæ, with short sub-conical joints, the second being only half the length of the third ; the elytra are oval and convex. The species of this genus are rather numerous, and of dull colours. The typical species, *Gal. tanaceti* (Linnaeus), being entirely black and rugose ; it is rather common, and creeps very slowly. It takes firm hold, however, upon the plants on which it is found, by means of the cushions with which the underside of the feet are furnished.—It varies in length from one-third to half an inch. There are twelve other British species.

GALIUM (Linnaeus), an extensive genus of European annual, biennial, and perennial weeds, some of

which are, however, pretty, and frequently met with ornamenting waste grounds or dry banks, and familiarly known by the name of ladies' bed-straw. The *G. aparine*, or cleavers, is one of our most common hedge-bank plants, and well known from the circumstance of its seed-vessels or hurs cleaving to the dress of persons coming in contact with it. It belongs to the natural order of *Rubiaceæ*.

GALLINIDÆ (poultry, and birds resembling poultry). A very numerous and well defined order of birds, consisting of numerous genera, and probably in strict systematic arrangements, of several distinct families ; but we shall be enabled to shorten our description of them, by bringing into this article the whole, except such as we have already described in the articles ARGUS, CURASSOW, and some others. In Cuvier's system, the pigeons and doves are included as a section of the order ; but they are sufficiently distinct and peculiar for being made the subject of a separate description and we shall include them all in one general article, PIGEON, which will be found in its place in the alphabet.

In the meantime, therefore, we have to deal only with the *Gallinidæ* properly so called ; and we shall first offer a few remarks on the general characters of the order, and then enumerate the leading genera, adding particular descriptions of those species which may appear to be most worthy of attention. The legs of these birds are all formed for walking, and the upper parts are, accordingly, well supplied with muscles ; but the muscles in them are not so completely concentrated upon the legs, as they are in the ostrich family, and other birds which have no power of flight. On the other hand, the gallinidæ, though not in any case birds of long flight, are remarkable for the facility with which they can take the wing, and also descend. The peculiar structure of their wings, as adapted for the accomplishment of those purposes, will be found explained in the article BIRD ; and we shall, probably, have occasion, in the sequel of this article, to advert to some of the variations of structure which characterise particular genera or species. The front toes are mostly united at their base by a short membrane, and toothed along their margin ; the upper mandible arched, the nostrils pierced in a broad membranous space at the base of the bill, and partially covered with a cartilaginous scale. They have short wings, a heavy gait, a bony sternum, diminished by two notches, so deep and broad that they occupy nearly all its sides ; its ridge obliquely truncated forwards, so that the sharp point of the fork is united to it only by a ligament ; circumstances which, by greatly weakening the pectoral muscles, render their flight laborious. The general number of the tail feathers is fourteen, but it varies from that to eighteen or twenty. From the structure of their larynx being simple, their note is seldom agreeable. Their crop is very wide, and they have a very vigorous gizzard. Nearly the whole of the species lay and hatch their eggs on the ground, on bits of straw, or herbage carelessly put together.

In many of the genera, though not in all, the males are polygamous, each having a number of females in his train ; and as is the case with all birds which have this habit, the males fight battles of gallantry with great courage and determination, and the females, as is also the case in the other races, fall to the lot of the victor. This peculiarity in polygamous birds has never been very satisfactorily explained upon physio-

logical principles ; but it should seem to have at least some connexion with the preserving of the spirit and vigour of the race. The monogamous ones do not show this pugnacity, but dwell apart and in peace with a single female, and their brood, to which in general they are much more attached than the more warlike polygamists. It is from this habit of shedding his blood for the sake of the other sex, on the part of the common domestic cock (*gallus*), that duels and strifes in the matter of females of the human race came to be called "gallantry," which again became expressive of all particular and marked attentions to the sex, and subsequently bravery in a general sense. In the polygamous species, the males take no share in preparing the nest, or rearing the young, which are for the most part very numerous, and capable of running immediately after issuing from the shell. The female guides and protects them till they moult, and calls them together by a particular cry for feeding.—The males are furnished, in most species, with spurs on their tarsi. They walk and parade very majestic and graceful, and run nimbly ; but they fly with difficulty, and a whirring noise. Though they chiefly subsist on grain, and the seeds of plants, yet they likewise eat insects, grubs, and worms, which are macerated in their crop. Their gastric juice, it appears, will not dissolve entire grains ; for those of barley, for example, inclosed in tubes, or perforated spherules, are not affected by its action ; but, should the same grains be by any means broken, or ground, they dissolve very speedily. The food undergoes previous trituration in the gizzard, a very strong muscular viscus, whose internal coat is hard and cartilaginous. However, as this is not the sort of animal substance suited to the reception of glands, or to secretions, the gastric juice in this family is not supplied by the stomach itself, but by the gullet, in which the feeding glands are placed, and from which it trickles down into the stomach. Spallanzani, from this peculiarity of nature's economy, appears to have been struck with the resemblance between the stomachs of gallinaceous birds, and the structure of a corn-mill ; for, while the two sides of the gizzard perform the office of the mill-stones, the crop, or craw, may be compared to the hopper. When our domestic fowls are abundantly supplied with food, they speedily fill their crop ; but its contents do not pass immediately into the gizzard ; and at all times they enter in very small quantities, in proportion to the progress of trituration.—The principal part of the species belonging to this order are very quickly, and without much trouble, tamed, and on account of their flesh, their feathers, and eggs, are very useful to mankind.

So valuable, indeed, are they in both respects, that it is doubtful whether they are more prized as domesticated, and in the species which form the ornament, and at the same time contribute not a little to the wealth of the farmyard, or in the others which are still under nature, or at most in a state of prolation, not of domestication.

The range of these birds, in the different genera and species, is greater than that of perhaps any other order in the whole class. We find them resident all the year round in the very extreme of latitude, upon the wilds of Lapland, in that dreary wilderness which forms the northern portion of America, and on the tops of the most lofty mountains in our own country. There they abide, habitually higher than any other living creature, and changing their colours, so as to

resemble lichen-clad stone in the summer, and the unstained white of the mountain snow in the winter. Then, when we come to the less elevated but more extended heath, which is still a wilderness, we find other races which make such situations their permanent abodes ; and where, notwithstanding the many enemies to which they are exposed, they breed in vast numbers. So also when we come to the hollow in the wilds, the bushy margin of the wild morass, we find that it too has its peculiar race of gallinaceous birds ; for there the black cock is as constant to his locality as the ptarmigan is to the summit of the lofty mountain, or the red grouse to the upland moor. As little does the pine forest lack its bird of this order ; for in the vast assemblages of pine and other trees of giant growth, which fill the dells and frown over the steepes of the Scandinavian mountains, the wood grouse, one of the most splendid birds of the whole, is found in such numbers as to form a considerable article of export trade. This fine species was once native, and, according to the older accounts, not rare, in the northern parts of our island ; but it has disappeared for these many years, and there is no doubt that it is now extinct. We believe that attempts have been made to introduce it artificially into the artificial pine woods, but they have not succeeded, whether from the circumstance of the bird not meeting with its proper food in these places, or from any other, we are unable to say. This much, however, is certain, that the native pines, among which the wood grouse was wont to dwell, in the Highlands of Scotland, rivalled in quality those among which it still dwells in Norway and Sweden ; and that the planted pine which have come in their stead are very different and very inferior. We have heard it remarked that the planted pines, and especially the spruces, none of which, we believe, were ever natives of the Highlands, destroy the bilberry, the heath-berry, and the juniper, which are understood to furnish these birds with a considerable portion of their food ; but what truth there may be in this, we have not the means of ascertaining.

When we descend to lower elevations and richer pastures, these birds still accompany our steps, and we have no sooner taken leave of the grouse at the margin of the moor, than we find the partridge on the first cultivated ground, and it continues with us till we come almost to the threshold of the rustic dwelling, to the close vicinity of the town, or to the shore of the sea ; and though the quail is now rarely, if at all, resident in the British islands, we find it inhabiting still lower down ; but the quail is a more discursive bird from country to country than those which we have mentioned.

All the gallinidæ which can be considered as of polar or northern extraction seem to be common to the two continents, or at all events not to differ much more than the mammalia of which the same genera are common to both ; and from the readiness with which most of the birds of this order adapt themselves to circumstances, and take a type from those circumstances, we might be prepared to expect at least as great differences as there are between the grouse of the eastern continent and the grouse of America, even though both may have been originally of the same stock.

When, however, we come to the southern latitudes where the wide seas cut off the continents from each other, so that they are too distant for land birds generally, and for gallinaceous birds especially, passing

from the one to the other, we find that they are all different. Of the species which are best known as migrant birds in Europe, the greater number are from the south-east of Asia, the common country of the domestic cock, the peacock, and at least all the more gaily dressed species of pheasants. In Africa we have the Guinea fowl, and in America, the most characteristic bird is perhaps that which has been, absurdly enough, called the "Turkey," as if it had come from quite another part of the world.

All these birds of the warmer and the tropical latitudes are more of woodland birds than the majority of the northern ones; and though they all feed, and most of them nestle, on the ground, they are, generally speaking, perchers; and so strong is this habit in them that even those which have been domesticated from time immemorial retain it, and always, if they can, mount to a perch for the night.

Such is the geographical distribution of the leading members of the order; and it will not fail to occur to the reader that they are most abundant in those places of the world which are also the chief native haunts of the ruminating mammalia. Indeed, in as far as there can be a resemblance between birds and mammalia, there is a considerable resemblance between the gallinidæ and the ordinary ruminantia; and it would not perhaps be any very great stretch of fancy to trace a resemblance between the camel family of the ruminating animals and the ostrich family. The gallinidæ, like the ruminants, are all feeders upon the ground; and although the mammalia are by no means so miscellaneous in their feeding as the birds, but confine themselves more exclusively to vegetable substances, yet the birds prefer vegetable food when they can find it properly suited to their taste. There is even a coincidence between the sections of the one order and those of the other, which is too striking for being overlooked. Those of both which are most homeward, and inhabit the fattest pastures, have the flesh most tender and delicate, and the human stomach can bear it for the greatest length of time; while those which are more distant and shy in their inhabiting have the flesh of higher and more pungent flavour, but less congenial to the stomach. A person in good health could contrive to dine daily, for a long time, upon beef or barn-door fowls, but would soon tire if wholly confined to venison and grouse, or even pheasants.

There is something very pleasant, and not a little worthy both of remark and of admiration, in those natural coincidences. Those things, whether of the animal or the vegetable kingdom, which are capable of furnishing man with the most abundant, the most nourishing, and the most wholesome food, are the very ones which come, of their own nature and instinct, the nearest to the place of his abode. It is impossible not to perceive in this that there is an express provision for man in the very arrangement and system of nature; and that, if he will but take the trouble of observing and knowing all the powers and productions of nature around him, it will succeed and reward his exertions, and beacon the way to farther knowledge and more complete enjoyment.

Nor is it less worthy of attention, that there is always a corresponding beauty which accompanies utility in these matters. The orchard, the corn-field, the meadow, and the down, are associated with so many pleasurable feelings, that the very mention of them is music to the ear; and every feeling of rural

innocence, and full abundance, and beauty, and happy content, is linked with the thought of the bleating flock and the lowing herd. The poultry-yard, too, has its charms; and if there be no crowing, and cackling, and gabbling, in the neighbourhood of a farm-house, or of any residence in the country, a heavy sense of desolation comes over the mind. Neither must we despise the sounds given out by the wilder species of this order. The sound of the wings of partridges, and their soft clucking cry when they "jug" in the field, and invite each other to the common safety and the common shelter, have something delightful in them. They are sounds which are heard only in the land of plenty; and the feeling of fertility, and all the joys which it brings arise whenever those sounds are uttered.

It is not, of course, to be supposed that there can be much internal resemblance between the gallinidæ and ruminating animals, because the feeding and digestive organs of birds differ much, taken on the whole, from those of the mammalia. But there is some resemblance. The gallinidæ have, generally speaking, three stomachs, and their intestines are more lengthened than those of most birds, and furnished with two cæcal appendages about six inches in length. These three stomachs are the craw, or pouch, into which the food is taken, as into little more than a simple store, where it is sent gradually to the other parts of the digestive apparatus. In this viscus the food undergoes very little change, though it may be partially softened. This craw opens laterally from the gullet. The second stomach is a dilatation of the gullet itself, and is furnished with glands which secrete a peculiar fluid; and it is here also that the drink of the birds mingles with the food. The third stomach is the gizzard, the texture of which is very strong and muscular, and the inner coat so hard and compact, as to have the appearance of firm cartilage. This viscus can exert a very powerful action, so powerful as to grind down glass and metals in a very short time, without appearing to sustain any injury. It is into this part of the structure the small stones and gravel are taken along with the food. The precise office which these perform in the digestion of the animal is not accurately known, but there is every reason for believing that it is very important; for it has been ascertained, by actual and repeated trial, that some of the order, the pheasants, for instance, can thrive as well on half the quantity of food, when they have free access to gravel, that they require when they have no such access. The inference of course is, that the gravel must, in some way or other, double the digestive powers of the bird, inasmuch as they enable it to draw equal, or even superior nourishment, from only half the quantity of food, but those assisting matters never substantially add anything to the nourishment. We have, however, already alluded to Spallanzani's somewhat whimsical comparison of this gizzard to a corn-mill, though it does not exactly hold, as the gizzard, which may be considered as the one mill-stone, grinds the others as well as the food, and the gastric juice afforded by the glands of the second stomach is mixed with the food before it reaches the gizzard; so that, if the action of it is a grinding action, it is not "dry-grinding," but rather resembles beating, or kneading in a mortar, along with a solvent fluid, which aids in rendering the harder substance.

We shall now very shortly mention the general

arrangement of these birds. Cuvier makes seven families :

1. ALECTORS (*Alectoridæ*), of which we have given some slight notice under that title. Of this family there are four genera ; Curassows (*Crax*), which have been already noticed ; Panxi (*Ourax*) ; Guan (*Penelope*) ; and Parraqua (*Otialida*).

2. OPISTHOCOMUS (the *Hoazin* of Buffon), of which there is but one species, and very little is known of it.

3. PEACOCKS (*Pavo*), forming two genera, the peacocks properly so called, and *Lophophorus*.

4. TURKEYS (*Meleagris*).

5. GUINEA FOWL (*Numida*).

6. PHEASANTS (*Phasianus*), of which there are four genera : Common Fowls (*Gallus*) ; Pheasants (*Phasianus*) ; *Houppifera*, *Tragopon*, and *Cryptonix*.

7. GROUSE (*Tetrao*), of which the genera, and also the species, are much more numerous than in most of the others. As it would exceed our limits, and be inconsistent with the plan of this work, to go into all the details, we shall advert most particularly to those that possess the greatest interest ; and, for this reason, we shall begin with those that may be considered as most typical of the order, and, at the same time, of most value to man.

GALLUS.—The common Cock, or common domestic poultry. This is the genus from which the order is named, and must, therefore, be considered as the typical one ; and it is so well known as not to require much description. The most general characters of the male bird are, a fleshy crest on the crown of the head, which usually consists of a single pectinated lamella, or plate, which is called the “comb ;” but it is sometimes double, or even formed into a kind of rosette. The sides of the base of the under mandible are also each furnished with a pendent lobe, of the same appearance and texture as the crest, and these are called “wattles.” When the bird is in “prime feather,” these appendages are of a bright crimson ; but when moulting, or otherwise in bad condition, they are pale ; and when the bird is exposed to severe cold, they are purple or bluish. The tail consists of fourteen feathers, seven on each side, which fold backwards against each other, like the leaves of a book, when the bird is on the ground or in a state of repose. The tail-coverts are much produced, and hang over the tail feathers in very graceful arches ; and they are often richly glossed with metallic reflections of bronze, purple, or green. The feathers on the neck are also very much produced and pointed. These feathers are called the “hackle.” In a state of repose, they form a mantle on the neck and upper part of the shoulder ; but when the bird is excited and shows fight, they are erected, and break the force of any stroke aimed against that part of the body. All the varieties have a naked space on the cheeks and round the eyes, which is of the same texture as the comb and wattles, and varies in colour in the same way. This character belongs to the female as well as the male ; but in the female the crest and wattles are merely rudimental, excepting in some individuals which have become barren, and they acquire a sort of neuter appearance, intermediate between that of the male and the fertile female. The male is furnished with a horny spur on the tarsus, which is his weapon of war ; and this, which is only rudimental, if at all visible, in the fertile female, sometimes appears in those that have become barren. When the female

has put on any of these appearances of the male, it may always be concluded that her barrenness is confirmed, and that she has ceased to be useful in a domestic point of view.

It would be in vain to attempt any description of the varieties of common poultry, as they occur in a domestic state. But though they have been familiarly known and very abundant in all parts of the eastern world pretending to any degree of civilisation and domestic economy, ever since, and even before the earliest historic records, it was long before any knowledge of their native country was obtained. Inured to almost every climate, from the greatest heat to the most intense cold, they appear to have accompanied the human race in all their migrations ; and as they are remarkably obedient to circumstances, even to those that are too minute for being observed by mankind, they take a type from countries, and even from districts. They vary much in size, and their tints and shades of colour are endless. Some have the tarsi bare, while others have their feathers down to the division of the toes. In some, the crest on the top of the head is replaced by a tuft of feathers, which is often very handsome ; but in some of the varieties, these feathers grow so long as to hang down over their eyes and obstruct the vision of the birds. Some have the comb and the wattles quite black, and when this is the case, the same colour extends to the periosteum, or membrane covering the bones, in all the skeleton. There seems to be a remarkable susceptibility to colour in the periosteum of these birds, which is soon communicated to the substance of the bones ; for when dye-stuffs are mixed with their food, the tint of the dye tells upon the bones. In many of the varieties, too, there are monstrous productions of the feet. Thus, for instance, a fine breed which are met with chiefly in the county of Surrey, and known as “Dorking fowls,” have five or six toes upon each foot. This formation is not, however, confined to that particular breed, but occurs in probably all breeds, for “a ten-toed hen,” is an expression known in many parts of the country ; and in the witching times, when charms and counter-charms were in repute, and all singular productions of nature were called in to help in the matters of weal or woe, the ten-toed hen had her use, much in the same way that the crowing of the cock was understood to send quietly to their repose in “the Red Sea,” during the day, those spirits of nocturnal fear which ventured to walk the earth when the clarion-sentinel of the village was slumbering on his perch. Absurd as these matters are in themselves, they suffice to show the interest which our ancestors took in those birds ; and, indeed, there is no animal which makes a more conspicuous figure in ancient history and fable than the common cock. His beauty, his bravery, his usefulness, and, as much as anything, his cheerful and early call, when the grey of morning has barely streaked the east, all conspire to render him one of the most interesting of birds. We give the following quotation from Pliny, as a specimen of the opinions of the ancients : “Next to the peacock,” says he, “the birds which are most sensible to glory are those active sentinels which nature has produced to rouse us from our matin slumbers, and send us to our daily occupations. They are acquainted with the stars, and every three hours they indicate by their crowing the different periods of the day. They retire to repose with the setting sun, and from the fourth mili-

tary watch they recal us loudly to our labours and cares. They do not suffer the day-beam to surprise us without timely warning. Their crowing announces the hour of morning, and the crowing itself is announced by the clapping of their wings. Each farm-yard has its peculiar king; and amongst these monarchs, as amongst princes of our race, empire is the meed of victory. They appear to comprehend the design of those weapons with which their feet are armed. It is not uncommon for two rivals to perish in the combat. If one be conqueror, he immediately sings forth his triumph, and proclaims his own supremacy; the other retreats and disappears, ashamed of his defeat. The gait of the cock is proud and commanding; he walks with head erect and elevated crest. Alone of all birds he habitually looks up to the sky, raising at the same time his curved and sithe-formed tail, and inspiring terror in the lion himself, that most intrepid of animals. Some of these birds seem actually born for nothing but warfare and battles; some have rendered the countries which produced them famous, such as Rhodes and Tanagra. The second rank is assigned to those from Melos and Chalcis,—birds truly worthy of the homage they receive from the Roman people! Their repasts are solemn presages; they regulate daily the conduct of our magistrates, and open or close to them their own houses. They prescribe repose or movement to the Roman fasces; they command or prohibit battles; they have announced all the victories gained throughout the universe; in a word, they lord it over the masters of the world. Their very entrails and fibres are not less agreeable to the gods than the richest victims. Their prolonged notes in the evening, and at extraordinary hours, constitute presages. By crowing all night long, they announced to the Bœotians a celebrated victory over the Lacedæmonians; thus did the diviners interpret it, because this bird never crows when he is conquered."

The cock is more stately in his march than any bird, or, indeed, than almost any animal. His tread is slow and firm, his step long, and his whole frame expressive of energy and vigour. The eye of the cock is lively and animated, his air proud and independent, without anything ferocious or menacing. He is a being confident in his own strength and courage, conscious of his own worth, but not disdainful of others. Sure of his own superiority, and of the right which he assumes, he knows how to maintain them in everything of importance, and how to relax in matters of less consideration. Though the cock reigns and rules like a bashaw over his harem, yet he is an attentive husband and a tender father. The females and their young are to him a people that must obey, but they must at the same time be governed with mildness. Their weakness and his strength secure submission on the one hand, and protection on the other. He desires no food for himself but as much as will suffice to support his strength; and should he chance to meet with anything delicate, he touches it not, but calls his family around him, who answer immediately to the voice of their master who summons them, and of a husband and father who invites. His acquisition he shares between the mothers and the children, answering to their murmurs of gratitude by lower and gentler accents. His progeny are protected by his acting either on the defensive or offensive against every enemy that assails them. He repels and combats with all intruding animals. And acts as

a master with the other birds of the poultry-yard, and compels them to keep at a respectful distance from his establishment. But his greatest wrath and irritation he exhibits against one of his own sex and species; he will contend with him until his adversary retreats by flight or is destroyed, or his own strength fails. He claps his wings, if successful, and utters several shrill and reiterated crows, in token of his success.

From the cock being of a warm and vigorous constitution, one will suffice for fifteen or twenty hens. To those, however, who are engaged in the breeding of poultry the choice of a cock is of great importance. He is judged to possess all the necessary qualities when he is of a fine shape, but middle size; when he carries his head boldly and erect, has a quick, lively, and animated eye, a powerful and clear voice, and a thick and short bill. He should have a bright and polished red comb, a membranous wattlè, of considerable size, and equally high coloured with the crest. The wings should be strong, the chest broad, the plumage very dark red or black, the thighs very muscular, the legs stout, and armed with long spurs, the toes provided with claws slightly crooked, and strongly acerated. He should also be alert and petulant in his demeanour, as well as prompt in defending the females; attentive in soliciting them to eat, in keeping them together during the day, and assembling them in the evening for rest.

At the age of three or four months the cock has arrived so far to maturity as to be able to propagate, which lasts in perfection four or five years, though he may live to the age of ten, and in some rare instances to fifteen years. The larger species and varieties of cocks are more slow in their development, and their prime, in all probability, lasts longer. When the cock becomes aged he must be turned out of the farmyard, as no longer worthy to figure there, and a young and vigorous one placed there in his stead. When the poultry-yard is divided between two or more cocks, peace reigns but a short time among them. Their jealous and impetuous character soon breaks out in frequent and bloody quarrels, combat follows instantaneously on provocation; the two adversaries stand opposed to each other with erected plumes, keeping the neck extended and the head low; with fixed and sparkling eyes they observe each other in silence; on the slightest movement from either they erect themselves, dart upon, and tilt their bodies against each other; this manœuvre is repeated until the most adroit and the strongest has torn the comb of his enemy, and overwhelmed him with blows from his wings, or gored him with his spurs. Some cocks are of a very quarrelsome and peevish disposition, they beat and annoy the hens, and are continually disturbing the establishments of their neighbours. The most simple method of quieting these refractory subjects is by passing a piece of leather over the foot, close under the spur; they then become as quiet as men who have got irons on their hands and feet. The cock is a very clean bird, is careful of his dress, and may frequently be seen engaged in cleansing, combing, and polishing his feathers with his bill. If, like the warbler or the nightingale, whose melody is created by love, he has no ambition to be distinguished by the excellence of his music, it is certain that he is very fond of exhibiting the strength, the sonorousness, and the compass of his voice. He listens after crowing, to hear if he is answered, and should another cock reply he recommences immediately, and appears

to defy him to raise his voice higher than his own. This emulous cry, repeated by all the cocks of a village, on an obscure night, has often struck the ear of the wandering traveller, and proved the happy means of directing him to the right road. It is very generally imagined that the cock is not designed by nature to share in the solitudes of incubation and the education of the young; but on a little more closely examining matters, we are forced to relinquish this opinion, at least as a habit to which there are no exceptions.

This leads us to a remarkable peculiarity in the physiology of these animals. It has been known from very remote antiquity, that changing the male bird of this species into what is called a capon, by depriving him of his sexual powers, greatly improves the quality, and even the quantity of his flesh. This is general in the case of mutilated male animals, provided the mutilation takes place at that early period of life when the external indications of sex have not yet displayed themselves, and the bird is in that state which may be regarded as neuter. The change which the female undergoes in respect of quality of flesh when it arrives at maturity, is not in any species of animal so great as that in the male; but still there is a change, and the flesh of the female is neither so good nor so abundant as that of the mutilated male. By preparing the capon at this early stage, and before any decided sexual character is acquired, the flesh is secured in the best condition, and the operation is performed with little or no risk.

Now, the remarkable physiological part of this business is, that the capon acquires so much of the disposition of the female, that he may be made to attend on young chickens, and watch and nurse them with all the solicitude of a hen. Experiments on this subject, which were made some time ago in France, are detailed by M. Parmentier, who mentions that capons have been trained not only to attend chickens, but to hatch eggs, an office in which the entire male bird never takes any concern. A strong and active capon is chosen for this purpose; the feathers are removed from the belly, he is rubbed with nettles, and made intoxicated with toast and wine. For two or three days this treatment is repeated, during which they keep him shut up in some narrow and confined place; he is then put into a cage with two or three chickens, which feed with him, hide under his belly, and, by their down, calm the smarts which the pulling of the feathers and the nettles have occasioned. He grows attached to them in a very short time, and calls them back when they quit him. Their number is augmented daily until he has as many as the volume of his body and the amplitude of his wings will cover. As soon as the intended number is completed, he must be left two days longer with them in a large cage, and then permitted to proceed forth conducting his flock, and he will prove as careful and attentive to them as the most assiduous female. Capons do not undergo the annual change in their plumage as other birds. Their voice loses its strength and clearness; they seldom attempt to make it heard, and are very melancholy and sad in their disposition. They are treated with great severity by the cocks, and they are held in detestation by the hens. They would very speedily fall a sacrifice to the persecutions of their companions, if they were not withdrawn to fulfil the object of their destiny by man, who has degraded them for his own purposes! This object is simply to

eat, drink, and sleep, that they may get fat as soon as possible for the use of the table, as they themselves can have no enjoyment in the matter. Sometimes hens are caponed as well as cocks, and the flavour of their flesh is very much improved in consequence. The epicurism of man has suggested various modes of fattening fowls excessively, all which are unnatural, and more or less cruel. The result, in fact, is always to produce disease, and more particularly of the liver. All those artificial modes of forcing animals into unnatural states either of general fat, or of the growth of some particular organ, are the results of vitiated tastes, and were more common in the dark and barbarous ages than they are now. There is a law which runs through the whole economy of those living creatures which are used as human food, and from that law there appears to be no deviation. It is this: No animal can furnish healthy food for man unless it is itself healthy at the time when it is prepared as food. Hence, those who violate this law, and seek to gratify a depraved luxury by bringing on disease in that which they eat, certainly lay, in this misguided sacrifice to the lowest of their animal appetites, a sure foundation for disease in themselves, and bitter repentance when it is too late.

In many parts of the world, especially in Egypt, and partially in France, and there is no doubt that it could easily be practised in any country, chickens are hatched by artificial heat in ovens, and reared by human care. This is so perfectly artificial a matter, that it forms no part whatever of Natural History, further than as it shows that after the mature egg is dropped, the real labour of the parent-bird is at an end; and that both substantively and actively, in so far as the egg is concerned, it contains all that is requisite for the development of the new being, and wants only the action of *any* heat, of the proper degree, to bring it to maturity. As this is, perhaps, the only opportunity which we may have of adverting to the progress of the development of the young of a bird, which is a curious matter, we shall here take a very rapid glance at it.

The germ, or as it is called, the *cicatricula*, in the recent egg, and before incubation, is very small. It is placed on the surface of the spheroid of the yolk; and, by a peculiar structure of the egg, it always keeps the upper side, in what situation soever the egg may be placed. The white of the egg is much less susceptible of putridity than the yolk, or rather than the membrane in which the yolk is enclosed; and if, from the egg's lying long in one position, the yolk descends till the membrane comes wholly, or very nearly into contact with the shell, an action is apt to be excited in the membrane, different from the living action that commences in the *cicatricula*; and as every action in a living body or a germ of life, be it of which kind it may, which is not a living action, is an action of death and putridity, the life of the egg may be destroyed by this means; and it may give out that odour of sulphuretted hydrogen, which is so very noxious. This may happen in the process of hatching, as well as in an unhatched egg; for if the action of the membrane is too much for that of the embryo chicken, the life may be extinguished at the very time that it is just beginning to develop itself. Hence, hens, especially in the earlier stages of their sitting, are observed to turn their eggs, or if they do not this, the chance is, that some of the number will be addled and produce nothing.

The point which indicates the germ in the egg, is very properly termed the *cicatricula*, "the little union," for the real germ is then so small, that it does little more than indicate that there is in the egg, the union of a rudiment of life to be nourished, and a nourishing apparatus to bring it forward. There is thus some resemblance between the contents of the egg and those of the internal uterus of a viviparous animal when gravid. The living part is foetal, and the nourishing part is placental, in the one case as well as in the other; and there is the same double membranes, the same mysterious confine which both unites and separates, in the one case as in the other: and when pulsation begins, it is not the same in the vessels of the placenta and those of the chicken, any more than it is in the case of an uterine mother. This is the nice point, and could we see the first throb of elementary action here, one of the most marvellous of nature's secrets would be in our possession. But here there is a veil, behind which it is not given to mortal eyes to look. "Is the *first* impulse given by the placenta to the embryo, or by the embryo to the placenta?" This is the grand question, but we cannot answer it.

The case of the egg is far more wonderful than that of the living mother in placental connexion (or must we limit the expression to juxtaposition?) The egg may be carried to a long distance; it may be hatched in an oven, under another animal, by any heat indeed; and there is a tolerably well authenticated story of a tailor, who hatched the egg of a goose under him on his shop-board, and thus was in possession of "a tailor's goose that could fly;" and the especial wonder is, that the mother should be able to deposit the faculty of maturity in the egg along with the germ of the chicken. Truly this same egg is a wonderful thing; there is more in it than in all the products of wisdom and skill which man ever made, or ever can make. But we cannot afford to dwell upon it even in contemplation. The reader *may—and should*.

At the end of about twelve hours after the incubation commences, the *cicatricula* begins to act, slowly to appearance at first, but more rapidly afterwards, though the first start is the grand point in the progress. After there is an action begun, we can conceive how it may go on, because the elapsed time, however short, gives us a judgment of experience upon which to anticipate the future; but *a beginning* is a mighty mystery.

The parts develop in succession, some earlier than others, but they are at first all apparently formed of gelatine, though the predominating matter in the egg itself is albumen. The progress of growth is so slow and gradual, that it is not in itself an object of observation; indeed, growth is thus far like life, that we can see it only in its effects. The vertebral portion of the chicken is the first that we can trace, which we can do in that which is to be the head, and also the spine, even on the first day of action; and this is a direct proof that vertebrated animals are really, in the order of time, organised upon the spine, which points strongly to the brain, and its continuation in the first predial of the action of young life, though we are unable to regard the point as altogether settled. On the second day the vertebræ show rudimental existence, and about the same time the heart, as the centre of the vascular system, begins to be formed, clearly proving that that system is secondary and subordi-

nate to that whose centre is the brain. The neck and breast are formed on the third day; and the eyes and liver are formed on the fourth. The stomach and veins are formed on the fifth day; and the lungs and skin on the sixth. On the seventh the bill and intestines are formed; and on the eighth the ventricles of the heart and the gall bladder. On the ninth the thighs and wings are formed, and on the tenth the whole of the parts which constitute the chicken are in their places, and have already assumed the form which characterises them. They are developed still more on the subsequent days, acquire all the growth of which they are susceptible in this state, and the chicken becomes sufficiently strong to break the shell, which takes place after the lapse of three weeks. The principle of life introduced by the act of the male into the egg already commenced in the female ovary, most probably contributes to organise it for the end which nature has purposed. But immediately after this egg is laid the principle of life slumbers in it, until awakened by the caloric communicated by the sitting hen; it then in connection with this last agent, gives motion to the embryo which it is commissioned to animate. It communicates to it the faculty of increase, of employing in its organisation and nutriment all the substances which are enclosed with it in this isolated matrix, which, however, fulfils all the same functions as those of the mammalia. The yolk of the egg then augments in quantity at the expense of the albumen, the fluid part of which it absorbs. It becomes a nutritious milk, which is carried into the liver, elaborated there, and finally passes into the circulation. To the nineteenth day of the incubation, the yolk forms in the egg a distinct body from the chicken shut up in a separate capsule. The only communication which they have together is by vessels which hold the place of the umbilical cord; but it is introduced altogether on the nineteenth day into the abdomen, and so increases by its presence the volume of the chicken, that there is not sufficient room afterwards for it in the lymphatic bag where it was. It then bursts and the pulmonary organs come in contact with the air, which has penetrated into the egg, to fill the space occasioned there by evaporation. The chicken respire, whines, its vital force acquires more energy, it moves, its limbs are developed, its bill is brought into action, its shell is broken, and it then issues forth.

In all those places of Europe where the temperature is at all moderate, the common hen produces a great number of eggs in the course of the year; but always the more if properly attended to in proportion as the climate is warm. In the extreme north, as in the northern parts of Siberia, in the very extremity of Lapland, and in Greenland, and of course in the very north of America, they do not breed; but considering that they are originally from Judea, they have a remarkable range of climate. In order that the produce of a hen in eggs may be the greatest possible, she should have abundance of wholesome food, but not be fattened beyond a certain extent, for the eggs of over-fat hens are both few and imperfect. The hen should be placed in a situation rather warm and sheltered, have access to cold water and to gravel, and be allowed plenty of exercise, but in no case alarmed or driven when treated in this manner. A hen of a good breed will furnish about two eggs every three days, and if not allowed to sit, she will continue with little intermission for ten months of the

year, that is to say, in the course of this period she will produce about 200 eggs. No hen can rear above one-tenth that number of chickens, which shows the advantage of those artificial means of hatching which are resorted to in countries where human labour is not too valuable for being devoted to such purposes.

Numerous conjectures have been formed as to the species of India, which is the parent stock of the common fowls; but these are, of course, very vague, and indeed the wild ones are almost as much varied in the different parts of the south east of Asia, and the eastern islands, as the tame ones are in Europe. Temminck is of opinion, that the common domestic breed (some of the more striking varieties are understood to be from other sources) are hybrids, between two species still found in the eastern islands, and which agree more in the females with our domesticated ones, than is the case with any others of the wild ones. There are the Jago cock found in Sumatra and Java; and the Bankiva cock, found in the woods of the latter island. In both of these the females have rudimental combs and wattles as ours have, and this is said not to be the case with the other wild ones.

THE JAGO COCK (*G. giganteus*) is at least double the size of the common cock of Europe, with the comb and wattles red, as in the common cock. The colours are rich, not unlike those of the finer specimens of the common one. It stands very high on the legs, and marches in a very stately and majestic manner. The Europeans in India, call this magnificent species the *Kulm cock*, but the common belief in India is, that it is not indigenous in that country, and we believe that it is not found in the wild state there, unless under circumstances which lead to the conclusion, that it had strayed into the woods, as animals are apt to do in such climates. Some of these great cocks are highly valued as game birds; and the true game are known by having the irides white or pale straw yellow. A cock of this variety in the possession of Colonel Sykes, stood twenty-six inches in height, and measured twenty-three inches from the point of the bill to the insertion of the tail. The hen is a third smaller. When tired, this species rests itself on the first joint of the leg, in which position it is as high as the common species. Colonel Sykes brought a hen and two cocks to England in 1831. They bore the voyage and the climate very well, and by September, 1832, the hen had reared two broods. There is not the least doubt that they would agree with the climate of Britain quite as well as the common variety; and it is known that they have for some time been introduced into different parts of Italy and France, where they have succeeded very well.

THE BANKIVA COCK (*G. bankiva*) is a much smaller species, only about ten or eleven inches from the point of the bill to the insertion of the tail. The feathers on the nape, the neck, the back, the coverts of the wings, with the exception of the greater ones, are of a purplish maroon brown; the greater coverts of the wings black, with metallic reflections; the tail-coverts long, arched, and of a yellowish colour, with bright metallic reflections of reddish, the quills of the wings black, margined with red; and all the under part black, with metallic reflections. The naked parts red, of a bright tint; the bill and feet grey, and the irides of a straw yellow.

THE BANTAM COCK (*G. pusillus*) is originally from the same parts of the world with the Bankiva cock;

resembles that one much in size, and is supposed to be a mere variety of it, inhabiting more elevated places, as it is found in the allied genus of the pheasants, that the mountain species even under the equator, and where they are understood to perch for the night, have the tarsi feathered, which is the chief external distinction between the Bantam cock and the Bankiva. The exterior sides of the tarsi in the Bantam are covered with very long feathers, which reach down as far as the toes. The Bantam thrives well in a state of domestication, and is a valuable little breed, the male being exceedingly bold and pugnacious in proportion to its size.

THE JUNGLE COCK (*G. Sonneratii*) is very abundant in the woods of the higher jungles in the south of India, especially in those of the Western Ghauts on the Malabar coast. There are two species or varieties. The one is long-legged, and inhabits the thick woods in the mountain valleys, to the height of about 2000 feet above the level of the sea. The comb is very much toothed, the lower mandible furnished with wattles; the feathers of the neck produced, and spotted with white, furnished with membranous or cartilaginous tips, which appendages occur also in the female. Along with the white spots, these feathers in the male are mottled with black and dull reddish brown. The breast, abdomen, and back, are grey, streaked with white; the coverts of the wings are reddish chestnut, with the feathers terminating in cartilaginous discs of a fulvous colour; and the quills and tail-feathers are deep black. The female is smaller than the male, and is wholly destitute of the comb and wattles. The head in this sex is completely covered with feathers, and the colours of the body are duller, and marked with brown and red. This appears to have been the first species or variety which was found very abundantly in the wild state in the woods of India, and hence it was considered as the parent stock of the domestic fowl; but the difference in the primal, and the first (we believe) of this species being rarely domesticated in India, are against the supposition; and if the parent stock is still to be found in that country, it must in all probability be sought in one, or other, or both, of those to which Temminck has referred it.

It must not be forgotten, however, that the common fowl apparently is a distinct species, and in many varieties, is, perhaps, more abundant in India than in any other country. In those parts of the country where there are few Europeans, they can be bought for about twopence each. They often resemble the jungle fowl in colour, but they are uniformly without the cartilaginous discs on the feathers of the neck and coverts.

The other variety of Indian wild fowl is found in nearly the same localities, but at a much greater elevation, occurring in the scattered plantations as high up as 4000 feet above the level of the sea. The male in this one has a great deal of red on the plumage; and the female is brownish red, and without any cartilaginous spots. The eggs are shaped like those of the common fowl, but smaller in size; the crow and call of the cock have no inconsiderable resemblance to those of the Bantam.

THE NEGRO COCK (*G. morion*) is very probably nothing more than an accidental variety, at all events it is met with only accidentally. The comb and wattles, and also the skin and periosteum are quite black; and this gives the bird a dull and rather un-

sightly appearance ; but the flesh is quite as palatable and wholesome as that of those which have the most gay and brilliant colours.

THE FORK-TAILED COCK (*G. furcata*). The chief peculiarity of this species or variety is the form of the tail, which is not folded the one half upon the other, as in most of the species, but flattened and forked at the termination. This is a native of Java, and the Javese give it a name different from any others of the genus. The feathers of the nape and neck are brown at their bases, blue with purple reflections in the middle of their length, and golden green, dotted with black, at the points. The feathers on the back are also brown at the base, but the rest is blackish, with gold coloured reflections, and the extremities margined with brownish yellow ; the body of the feathers on the wing-coverts resembles that on those of the back, but the margins are bright red ; the quills are blackish brown, and the tail feathers golden green ; the crest is entire in the margins, and there is only one wattle under the lower jaw ; these, and the other naked parts of the head, are bright purple ; the feet and irides are yellow, and the spurs upon the tarsi are very sharp. The length of the male bird, including the tail, is about two feet ; that of the female does not exceed fourteen inches. The female has no vestige either of comb or of wattle ; the naked skin round the eye is reddish yellow ; the top of the head and the neck are brownish grey ; the upper parts are blackish golden green, streaked and spotted with greyish brown ; the throat white, the under parts brownish ash ; and the quills brown, bordered with reddish.

Those which have been enumerated are only a few out of the countless numbers that have been figured and described ; but the birds are so prone to break into varieties, that there is no depending upon a single specimen, or even upon several specimens, for the establishment of a species, or even of a variety, except a merely accidental one, which may break out in one as well as in another. Nor shall we go into any enumeration of the varieties of the domestic breed that are generally described. The habits of the whole genus *Gallus*, indeed, so much resemble each other, that the account of one may answer for the whole. There is, however, one result of their proneness to sport varieties, which may be worthy of some slight notice, and that is the monstrous formations which they sometimes assume, and which appear to be more singular than those of almost any other race of animals. "In 1802, a Jew exhibited for money, at Posen, in Poland, a hen with a human face, which was hatched in a farm near Wryesnier, and which he had received in payment of a small debt. He declared that another chicken, altogether similar, had been in the same brood, but that it died soon after its birth. The animal which he exhibited, and which I have myself seen, was alive, and in excellent health. It had attained its full size, for it was more than a year old. Its body was covered with feathers of different colours, and it resembled other hens in every respect, except the head ; this was of the usual size but denuded of feathers, and covered with a bluish skin. The cavities of the eyes were completely like those of human eyes ; they were surmounted by two small arches of down, which formed very regular eyebrows. The upper part of the bill was shorter than usual ; it had but one blunted point, and the nostrils were underneath it, so that, although it was horn, it presented the perfect resemblance of a very

well-made nose ; below this nose was a very regular mouth with lips ; two rows of very white teeth, close and pointed, and a rounded tongue, completed this most extraordinary *lusus naturæ*. This resemblance to a human countenance had something in it extremely disagreeable, and even horrid ; but was perfect, and had no need of the assistance of imagination to be recognised." The Gazette de Santé, in the year 1810, published an account of another phenomenon of this kind. But the resemblance to a human countenance was not quite so perfect as in the last, yet was nevertheless very obvious. The writer of the article says, "The place where the bill should be presents a human profile, resembling that of an old woman ; the bill is entirely wanting ; the jaws are shortened, so as to terminate in a point where the nostrils are placed in other hens ; they are covered with flesh, and resemble lips. The crest, on a face view, forms a kind of nose, so much the more remarkable as the nostrils are placed at the point where this nose terminates, and are united to the jaw. A fleshy excrescence, not seen in other hens, is attached below the under jaw, and represents a sort of chin ; this chin is naked, with the exception of a few hairs, and the naked skin which forms it is prolonged as far as the ears, as in the common hen. The eyes are round and black, and surrounded with an iris of a very lively red. Under the eyes the skin is flesh-coloured, mingled with blue, and naked, with the exception of a tuft of hairs, forming a kind of mustachio towards the ears, and concealing the apertures." Many other instances of a similar kind are recorded ; but those which we have quoted must suffice as a specimen, the more so that they are mere curiosities, from which no useful conclusion can be drawn.

PHASIANUS—Pheasant. This is a very interesting genus, most of the members of which are alike remarkable for the elegance of their forms and the beauty of their plumage. They are not by any means so social as common poultry, and none of the species can be said to be in a state of complete domestication. They are nearly allied to common poultry, so much so that when domestic hens become wild in parks, which they often do when they have free range in large ones, they produce hybrids with the common pheasant ; but whether these hybrids can breed with each other, as is the case in crosses with mere varieties of the same species, or only back to the pure blood, as is the case with mules between different species, has not been ascertained in a satisfactory manner. In this case, however, as in all similar ones, it is the domesticated female and the male in the wild state that produce the hybrid ; and we believe that there is no instance of one between even one of those domestic cocks that become wild in the woods and a female pheasant. Nor is it understood that the hens go astray after other lovers in the wild places until the males of their own race are gone.

The leading characters of the pheasant genus are : the bill rather short, but thick and stout, naked at the base, and bent down at the tip. The nostrils lateral at the base of the bill ; the ears covered with feathers ; the feet with four toes, three to the front and one behind, fitted for walking and for scraping the earth, as is the habit of many of the order ; the tarsi of the male furnished with spurs as in the common cock ; the tail lengthened, wedge-shaped, and composed of as many as eighteen feathers, which are in some of the species very much produced. The wings are

short and hollow ; and though the birds are much better fliers than common fowls, especially when these are in a state of domestication, their flight is heavy and fluttering, and apparently produced with considerable effort.

All the known species are natives of Asia, and they are inhabitants of woods or wooded places, where they perch in trees during the night, but they feed and nestle upon the ground. As is the case with most of the order, their nests are very rude and hardly deserving the name. The broods are numerous, but the numbers vary a good deal with the characters of the climate. The young, when they first make their appearance, are covered with soft down ; and they can run and pick up their food almost as soon as they break the shell. There are several species and varieties of pheasants, besides hybrids between the different ones, and between the male and other gallinidæ ; and though in general they are, as wild birds, more constant to their colours than domesticated birds, there are often coloured varieties, and even albinos.

THE COMMON PHEASANT (*P. Colchis*) is so called from the country whence it is said to have been first brought to Europe, which is generally understood to have been from the banks of the river Phasis, in the ancient state of Colchis, or the modern province of Mingrelia. They are now, however, pretty generally introduced as ornamental birds into all the more warm and temperate parts of Europe ; and on the continent they are found as far north as the countries adjoining the northern bay of the Baltic, and in Asia as far as Siberia. In all places where they are found, their appearance and their flesh are both highly prized, but they cannot be considered of much value in an economical point of view, as they can hardly be said to be in the possession of the real cultivators of the ground, and breeders of domestic animals for economical purposes. It furnishes our tables with a very delicate article of food, and adorns our parks and thickets, which it greatly enlivens. From its having short wings, it flies rather heavily, and to a short distance at a time. It is with difficulty tamed, being naturally very shy, living in a very solitary manner, and, except in the pairing season, it seems averse to consort even with those of its own species. Yet when these birds are in the constant habit of being attended in the coverts by a keeper, they will immediately attend his whistle to be fed ; nay, will follow him in flocks, and will scarcely allow the peas to run into the trough before they begin to eat ; and those that cannot find sufficient room at one trough will follow him with the same familiarity to another. They are fond of buck-wheat and corn, but will frequently feed on the wild berries of the woods, and on acorns. They feed their young on insects, worms, and the pupæ of ants. They are fond of the shelter of woods and thickets, but will very frequently breed in clover fields. The nest is made on the ground, and is generally composed of dry vegetables very carelessly put together. The female endeavours to conceal it from the male, and lays from ten to sixteen eggs, which are somewhat smaller than those of the common hen, and of a greenish grey colour spotted with brown. The incubation lasts rather more than three weeks ; and as soon as the young break the shell they follow the mother like chickens. Should they not be disturbed, the parents and their brood remain in the hedge-rows and stubble for some time ;

but if molested or scared, they will quit those places and betake themselves to the woods, and come forth only to feed in the morning and evening. In a confined state the female neither lays so many eggs nor hatches and rears her brood with so much care and vigilance as in the fields. In a mew she will rarely dispose her eggs in a nest, or sit on them at all ; so that the domestic hen is usually entrusted with the charge of hatching and breeding the young. The female pheasant is less careful in calling her brood together than the partridge, even when enjoying greater freedom ; but she will shelter as many as seek protection under her wings. After all, about one-third of the young race never attain to full growth ; for many fall a sacrifice to the first moulting, and several to a disorder which proceeds from the presence of a species of fasciola in the trachea called "oscitans" or "gapes." A very considerable number of their eggs is sometimes destroyed by the mowing of clover near woods which pheasants frequent. As the cold weather approaches, these birds begin to fly at sunset to the branches of the oaks, which they roost among during the night ; and this they more frequently do as the trees lose their foliage, and winter advances. The males on these occasions make a noise which is technically called "cocketing," which they repeat three or four times ; but the hens utter one shrill whistle only on flying up, and then remain silent. The sportsman reckons the pheasant a bird of easy conquest, owing to its size and awkward noisy flight ; and it is even reputed stupid, because, when roused, it will often perch on a neighbouring tree, and have its attention so rivetted on the dogs as to suffer the sportsman to approach very near. The old cocks, however, have been observed to have recourse to various stratagems, in thick and extensive coverts, before they are compelled to take wing ; and Le Roy has remarked, that they regulate the hours of their repast by the seasons. The crowing of the males, which commences in the beginning of March, may be heard very frequently at a considerable distance.

There are many species or varieties of pheasants (for in these birds it is not a very easy matter to distinguish what is a species and what a variety) found in the south-east of Asia, from the islands northward to China. One of the most remarkable of these, in size, in the peculiarity of its plumage, and in the richness produced by various contrasted tints of a few original colours, will be found described in the article ARGUS, and some idea of the appearance of a few of the more elegant ones may be formed upon inspecting the plate "PHEASANTS." The manners of the whole are pretty similar ; though, as might be expected, the more recent importations from warm countries are not quite so hardy as those which have long been inured to cold climates. We shall give very brief notices of a few of the more remarkable.

THE GOLDEN PHEASANT (*P. pictus*). The painted pheasants are natives of China, from which they have been introduced into the parks and aviaries of Europe. They are reared in this country with as much ease as the common species, and they appear to be more familiar in their habits. On their first introduction, this was not supposed to be the case, and therefore they were nursed with very great care, and the successful breeding of them was considered even as something very fortunate, notwithstanding all the care which was bestowed on them. That it was fortunate is very true, but the fortune lay exactly the other way

from that which the parties supposed, for they were so much encumbered by the excess of human attention that their native powers were rendered much less efficient than they would have been had they been left altogether alone.

This is a matter worthy of great attention, in the case both of animals and of plants, because there is always more danger that exotics shall, upon their first introduction, be killed by over-kindness than that they shall suffer from neglect. The more beautiful any living or growing thing is, the more are we disposed to associate it with delicacy of frame; and hence we are apt to poison both plants and animals by our heat and confined air, when, if we left them to shift for themselves in a state of nature, they would not only live but become vigorous, and speedily adapt themselves to our climate.—The male bird, when in full plumage, is nearly three feet in length, of which the tail forms two-thirds. The female is not only smaller and has a much shorter tail, but the whole of her plumage is less gay and splendid. The young males resemble the females, and are not invested with all the richness and brilliancy of their attire till they have moulted a second time. The females, on the other hand, at the age of five or six years, sometimes put on the male plumage. From the head rise some long bright yellow feathers, which hang gracefully over its hind part, the colours of which, together with the sides of the neck, are orange and black. The distinctive golden tinge is mixed with green on the back of the neck; the feathers of the back are bright yellow, bordered with crimson; deep blue surmounts the base of the wings, which are beautifully varied with chestnut, brown, and red. The feathers of the tail are chestnut and black; and above the base bright scarlet, which is the colour of all the under parts except the neck, the latter being dusky brown. The iris, bill, and legs are bright yellow. They feed on rice, hemp-seed, wheat, or barley, and they will also eat cabbages, herbs, and fruits; but they are particularly fond of insects, the difficulty of procuring a sufficiency of which is supposed to be a principal cause of the many disorders to which they are liable. The female begins to lay her eggs early in March, which very much resemble those of the Guinea pintado, and are redder than those of the common pheasant. The flesh of the present species is considered superior to that of any of the others. The painted or golden pheasant will breed with the common, but the offspring is infertile in the hybrid, though there is no doubt that, as is the case with all mules, it might be made to breed back to the pure blood of either parent. From their known hardiness and their extreme beauty, it were highly desirable that these birds should be multiplied in all ornamental grounds; and it is still more to be desired, though the means of gratifying the desire are not very apparent, that such a feeling should be disseminated among the uneducated ranks of the people, as that they should respect those birds, not only as the property of their lawful owners, which it is a crime against the laws of society to invade, but that they should respect the beauty of such birds as among the public ornaments of their country, the injuring of which is a violation of a much higher law than any which man can enact, and that the consequence of the invasion of this is their own moral degradation, and certain wretchedness and misery.

THE SILVER PHEASANT (*P. nymphaus*). This

species, which is sometimes called the pencilled pheasant, is still more hardy than the preceding one, and has been reared and domesticated with nearly as little care as the common fowl. Its robust constitution approximates it more to common domestic poultry than the other pheasants. Its education requires only very moderate attention. The form of its caudal plumes, and the mode of their insertion, also present great analogies with the domestic cock. The plumage is less brilliant than that of the golden pheasant, and is about four or five inches shorter. The cheeks are bright red, and the top of the head has long black feathers falling backwards. The back, wings, and upper part of the tail, are of silvery white pencilled with black; the under parts are purplish black. It has two long tail-feathers of pure white; the bill is dusky yellow, and the legs are deep red. The trachea of this pheasant is straight through its entire length, and grows narrow only towards the lower larynx, as in the cocks. The upper part of each bronchus has three demi-rings, which are separated by two wide membranous intervals. The upper larynx and hyoid cartilages are also similar to the same parts in the cocks. The male bird of this species is of a warm constitution. The pairing time is about the latter end of April. The female attends with great assiduity to her young brood, when she has sufficient liberty. The incubation lasts rather more than three weeks. The number of the eggs varies from ten to sixteen; and sometimes, but very rarely, to eighteen. The colour of the eggs is yellowish red, often bordering on black, and they have small brown points on them. It has been brought into almost all the countries of Europe from the north of China, and thrives very well with but little attention.

The plumage of the silver pheasant is by no means so brilliant as that of the golden pheasant; but from the delicacy of the colours and the fineness of the pencilling, and also from the greater lightness of its form, it is doubtful whether it be not the more elegant bird of the two. In length it is usually about four inches shorter than the golden; and its other dimensions are less in the same proportion. The two, however, from the striking differences of their colours make a very agreeable contrast.

THE RING-NECKED PHEASANT (*P. torquatus*). This is likewise a native of China, and closely resembles the common pheasant naturalised in our woods. M. Temminck, however, has pointed out the distinctions with great nicety. There is a white collar about the neck of this bird, from which it takes its name. In 1831 one of the Zoological Society's specimens, which laid eggs the preceding year, exhibited the phenomenon, occasionally observable among birds, of the female assuming the characteristic plumage of the male. The upper parts of this species are blackish, clouded with yellow, and streaked with white; the top of the head is yellow, clouded with green; over the eyes are two white markings; the sides of the hind head, the upper part of the neck and the throat are green, with brilliant purple reflections; and, as already hinted at, there is a large white collar on the neck, which extends towards the sides. The breast is reddish purple, clouded with violet; the middle of the under part whitish yellow, spotted with violet; and the abdomen black, with metallic reflections. The wing-coverts are grey, clouded with green; and the quills olive, waved with large bands of black. The tail-coverts are bright green, the feet grey, and

the bill and irides yellow. The length of the male is about nine and twenty inches. The female is much duller in the plumage, and is marked over the eyes by a streak of short black feathers.

REEVES'S PHEASANT (*P. Reevesii*). This is likewise from China, and was unknown in England, at least in the living state, until the establishment of gardens for the reception of animals by the Zoological Society of London. A specimen, sent to the garden by Mr. John Reeves of Canton, arrived in safety, but another one died by the way. The bird is from the north of China. It is a splendid species, the middle feathers of the tail in the male bird measuring between five and six feet in length. It is *Phasianus veneratus* of Temminck.

There are numerous other pheasants, most of them finely coloured, of which specimens have been brought from China, especially from the northern parts of that country. The north of China seems indeed to be remarkably well adapted as a pasture for pheasants; for the species or varieties which have been obtained from thence are larger and finer in their plumage than those of the south of China, or even farther to the south. And it is highly probable that in this grand head-quarter of the genus, there still exist many species which are unknown to Europeans.

The north of China has a very severe winter, as cold as it is in the middle latitudes of Sweden, which is considerably more rigorous than it is in the extreme north of the British islands, while the heat in summer is as great as in northern Africa, near the borders of the desert. So great a range of temperature in the course of the year must be very trying to the constitutions of the wild animals; and those which can bear such alternations of heat and cold must be regarded as especially hardy. This is an important consideration in the natural history of the finer species of pheasants, because it furnishes the most conclusive proofs that those most elegant and highly ornamental birds could be introduced without difficulty into any part of the British islands, at least without the least chance of injury from the winter. This is a consideration well worthy the attention of those who wish to combine beauty with usefulness in the stocking of their parks; but it is one upon which our limits prevent us from enlarging further, and so we must pass on to another genus of the family.

PAVO—the peacock. This is a genus which has been long known and generally admired, and it is, in some respects, one of the most beautiful of birds. The generic characters are: the bill naked at the base, convex in the upper part, thickened, and bent downwards at the tip; the nostrils open; the cheeks partially bare of feathers; the feathers of the rump elongated, broad, capable of being spread out like a large fan, and marked with ocellated spots of beautiful form and most brilliant colours; the true tail is wedge-shaped, and consists of eighteen feathers, the extending of which assists greatly in producing the regular fan formed by the feathers of the rump; the head is furnished with a crest; the feet have four toes each; and the tarsi are furnished with conical spots.

COMMON PEACOCK (*P. cristatus*). The crest on the head is compressed laterally. The body of the male is golden green, glossed with bronze reflections; and the wing-coverts green gold, glossed with bronze and blue, the colours in all these parts being remarkable for the beauty of their iridescent play of different colours. The under parts of the body are dusky, but

clouded and relieved with green gold. On each side of the head there are two stripes of white. The upper tail-coverts, or rump-feathers formerly alluded to, are very long, and adorned with various colours and beautiful eyes and arches. Indeed there is not a flower in the garden, a metal, a gem, or a tint in the rainbow, which does not find its rival in one part or other of the peacock. The details of the markings could not be enumerated, except in a very lengthened description; and this description, however it might be laboured, would convey but a very faint idea of the splendour of the original. Some of the pheasants, which we noticed in enumerating the leading species of the last genus, are tame in words compared with what they are to the eye; and therefore it would be vain to hope, by means of words, to convey any idea of the peacock. Perhaps the most expressive compliment which has been paid to this bird is a mythological one; the ancient fabulists having deemed the peacock the only animal fit for being yoked to the car of the queen of heaven. But splendid as this bird is, much description is not necessary; for it is so common and so hardy, that, in almost any part of the British islands, only a very short journey is necessary to get a sight of it.

The ordinary length of the full-grown peacock, from the tip of the bill to the extremity of the tail, when in the finest condition, is about four feet. The female is considerably less; and her train is not only very short, but destitute of those resplendent beauties which ornament the male; her crest too is much shorter, and her whole plumage partakes of a sober cinereous hue; her throat and neck are green, and the spots on the side of the head are larger than those of the male. The females of this species, however, like those of the pheasant and of some other birds, have occasionally been known to assume the male attire.

As is the case with most birds in a state of domestication, peacocks often exhibit considerable variety in their colours. Some, for instance, have the wings crossed with small striæ; others have the wings, cheeks, throat, and anterior parts of the belly, and also the wing-coverts white; and specimens in a state of perfect albinism have occurred, in which scarcely one departure from white could be discerned in the whole bird, except that the white on the eye-spots of the tail seemed a little duller than in the other parts of the same feathers.

From the number of peacocks which are still found in India, especially in the richly wooded dells of the western ghats, not a doubt can be entertained of India being the native country of these splendid birds. Some of the places which they inhabit there are peculiar and picturesque in a very high degree. There are often circular valleys, or as one might almost call them cauldrons, so narrow that the eye of one standing on the brink can overlook their whole extent, so deep and so steep in the sides that it is impossible to descend into them, and with the outlet so rough and so choked with vegetation that a passage that way is equally difficult. In those singular places, peacocks may be often seen in swarms; and the brilliancy of their colours adds greatly to the other characters of those curious places. Of course they feed on the ground, in the openings between the trees; but the places of their repose, both when resting for the day and for sleeping in the night, are upon the topmost branches, where they make a very brilliant appearance.

In this country the peacock is a very hardy bird, braving, out of doors, all changes of the weather, and roosting in the lofty trees, instead of seeking the same humble shelter as the common fowls. It is worthy of remark, as a peculiarity in the natural history of those splendid natives of tropical climates, that they are found wild in the forests of the north of Europe. Of course they are not indigenous there, but have escaped from confinement, finding the forest more congenial to their habits than the vicinity of human abodes. It is in Norway that they are understood to spend the summer months; but in the severity of the Scandinavian winter they are frozen out, and are obliged to take their departure for more genial climates. It should seem, however, that the cause of this is want of a due supply of food, rather than incapacity to bear the severity of the winter. At that season of the year they are said to migrate into Germany, where, though the winter is still cold, they seem to meet with a more abundant supply of food. This fact, which appears to be well authenticated, is deserving of attention by those who are interested in promoting the natural decorations of the British islands; for if wild peacocks can live in Norway, and have voluntarily taken up their summer abode there, there is little doubt that they could, if the numbers were carefully increased, summer and winter in almost any part of our islands; and if we had our forests stocked with peacocks, it would add greatly to their beauty and interest.

When in a state of nature, and in the native localities of the south, the peahen is described as breeding only once in the year; but the accounts state that the eggs are very numerous, consisting of as many as twenty-five, or even thirty, at a hatch. These eggs are of a whitish colour, with dusky speckles; and the female is understood to deposit them in some concealed spot, where they may be secure not only from beasts of prey and snakes, but also from the male, who is very apt to destroy them. In our northerly climate, and in a state of domestication, the peahen is not nearly so prolific. The number of her eggs seldom exceeds five or six, and her time of incubation varies from twenty-five to thirty days, according to the temperature of the place and the season of the year. In the warm parts of Europe she is more prolific. For instance, in Greece, she lays from ten to twelve eggs; and, in the absence of her male, she will likewise produce barren eggs, which the ancients termed "zephyrian," as they were supposed to result from the genial stimulus of the vernal gales. When pleased or delighted, and in sight of his females, the cock erects his tail, unfolds his feathers, and frequently turns slowly round, as if to catch the sun-beams in every direction, accompanying this movement with a hollow murmuring. His cry at other times is very unpleasant, which is frequently repeated, especially before rain. He sheds his superb plumes every year, and then, as if conscious of his loss, he courts the most obscure retreats, till the returning spring renews his lustre. The young acquire the perfect brilliancy of their plumage in their third year; but in cold climates, they require attention in rearing, and should be fed on grass, meal, cheese, crumbs of bread, and insects, until they are seven or eight months old, when they will eat wheat, and various kinds of grain, like other gallinaceous birds. In this respect, however, the peacock is extremely capricious, and there is scarcely any kind

of food which it will not, at some time or other, pursue. Tender plants and insects are often eagerly sought for at a time that it has a sufficiency of its natural food at command; and during the indulgence of these unnatural appetites, walls cannot easily confine it; it strips the tops of houses of their tiles or thatch, lays waste the labours of the gardener, roots up his choicest seeds, and nips his favourite flowers in the bud. In India one of its most mischievous propensities is picking at the eyes of children, which it probably takes for some glistening object of prey. It lives about twenty-five years, according to Aristotle, but Willoughby and others allege that it is capable of existing for near a century. When full grown it is not readily injured by cold, and an instance is quoted of one which was found quite frozen, and had lain for some days in the snow, in the court yard of a house in Dunkirk, in the year 1776, and which, by the application of a gentle heat, recovered from the accident, and continued to live as if nothing particular had happened. These birds are also found to thrive in North America, notwithstanding the severity and duration of the winter season. In our cold climates, however, they seem to be incapable of very extensive flights; but they roost aloft in trees, or on the tops of houses or steeples, whence they utter their discordant scream. Though long naturalised in Europe, they are of eastern origin, occurring in the greatest profusion in the neighbourhood of the Ganges, and in the extensive plains of India, particularly in Guzerat, Cambay, the coast of Malabar, the kingdom of Siam, and the island of Java. As early as the days of Solomon they were imported into Judea by the fleets which that monarch equipped on the Red Sea, and which, in all probability, traded to the coast of Malabar. From India they were brought into Asia Minor, and subsequently into the isle of Samos, where they were formerly much multiplied, and consecrated to Juno, but from which they have now wholly disappeared. In the time of Pericles they still fetched a high price in Greece. According to Ælian, thirty years after their first importation into that country, they were exhibited at Athens as a show to strangers; and he adds, that multitudes flocked to see them from Lacedemonia and Thessaly. Alexander had never seen peacocks till his Indian expedition, when he found them flying about in the wild state on the banks of the Hyarotis, in the Punjaub, or land of streams, and he was so delighted with their splendid appearance that he decreed a severe penalty upon any one of his army who should kill or even molest them. He carried them with him on his return, however; and it appears that they had bred freely, for toward the close of Alexander's short but brilliant reign, Aristotle speaks of them as birds familiarly known in Greece. The account of their importation into the country of the Jews, at a more early period than this, which is stated in the English translation of the Bible, is in all probability a mistake of the translators; because, if the living birds had been introduced there, it is highly probable that they would have found their way into other parts of the western world. They were not introduced into Rome till about the time of the decline of the republic; and, according to the account given by Pliny, the orator Hortensius was the first who introduced them at table, in a feast which he gave to the company or college of augurs. His example was, however, soon followed by others; and, as the luxury of the Romans consisted fully as much

in the mere ostentation of expense as in the real gratification even of the palate, they were even in great demand for the more splendid feasts, and rose to a most exorbitant price. When the Roman emperors had lost even the savage virtues of the earlier ages, in more ostentatious dissipation, they took a pride in having at their tables large dishes wholly composed of the heads and brains of peacocks, for the introduction of which there could be no imaginable motive but the great expense. With the epicures of modern times, the peacock is in small favour; and though the young are eaten, but not much in request, the full grown birds are not. Their flesh is tough, and has not a very agreeable flavour. The hardness of the flesh has, however, one advantage (if advantage it can be called) in hot climates, it resists putrefaction longer than the flesh of almost any other animal.

In the American continent, or even in Africa, there is no trace whatever of these birds as natives, but they have been introduced into both. The Portuguese, when they had the ascendant both in India and in Africa, introduced them into the latter country, where they were highly prized by the native princes. At later periods of history they have been introduced into various parts of America and the West Indian islands. In all countries they are regarded more in the light of mere ornaments than of any thing else.

Though these birds are hardy in enduring the weather, they are very sensitive to its changes, and give note of some of those before there are any indications which are palpable to the majority of the human race. In summer the screaming of peacocks, especially towards the close of the day, is understood to prognosticate rain, and they are not the only birds which naturally perform this sort of augury.

THE THIBET PEACOCK (*P. Thibetanus* of Linnæus) ought perhaps to be referred to another genus, and Temminck has done so, designating it by the generic name of *Polyplectron*, and specifically as *Polyplectron chinquis*. Cuvier, however, retains it in the genus *Pavo*, to which it is certainly allied. Its colour on the upper part is a bluish black, with metallic lustre; the feathers being bordered with golden green, beyond which there is a fringed margin of deep black. The top of the head is covered with short feathers of a soft velvety texture, of a golden green colour with blue reflections; and these feathers are surmounted by a tuft of twenty long and thread-shaped feathers with whitish shafts, and a row of bluish green points along each side, which give the crest the appearance of being toothed. The colour of these lateral points of the crest is very brilliant. The neck, the throat, and the lower part of the breast, are of a greenish blue of a very bright lustre, the feathers having at the end a gold coloured eye-spot bordered with bright blue. The lesser and middle coverts of the wings are green with blue reflections; and the larger coverts are greenish black, bordered with golden green. The quills are yellowish maroon, with the shafts and tips greenish black. The upper tail-coverts are bright golden green marked across with chevron bars of a yellowish colour; the tail-feathers bright green covered with brown. The under parts are black, with golden reflections; and the bill and feet are black. The secondary quills are ornamented with very brilliant blue spots, and the produced upper coverts of the tail with similar spots of green, two upon each feather; but the feathers are not nearly so much produced as those of the common peacock.

These birds are singularly beautiful; they are less than the common peacock, but larger than pheasants. They are found in the mountainous country between India and the Chinese territory; and, according to some of the authorities, they are also found farther south, in the Malay peninsula, and also in the islands. One of their most remarkable peculiarities is the number of spurs on the tarsi of the male, which are sometimes as many as six upon one leg; and there are often more on the one leg than on the other. The feathers of the tail are erectible and may be expanded like a fan, in the same manner as those of the peacock; but though there are more eye-spots on the single feathers, the appearance altogether is not nearly so splendid. The plumage of the female is much less brilliant than that of the male, and the tail-feathers are not nearly so long. The young birds are of an earthen grey colour, with lines and spots of brown. After the first moult, the colours are not so broken and irregular, and the positions of the spots on the wings and tail can be traced. After the second moult, they become more distinct and better defined, and display the rich gold and blue and green, which are so ornamental in the mature birds. It is not, however, till after the third moult that the colours attain their highest perfection. Even in the state of nature this species is by no means wild; and when in confinement, it is very soon reconciled to its condition, and breeds as freely as any other of the race. Altogether it is a very beautiful and highly interesting bird. The quality of its flesh as an article of domestic economy has not been mentioned, but the probability is that, from the similarity of the general appearance, it may in the adult state partake of the harshness of that of the common peacock.

Varieties of the peacock have been mentioned as occurring in the East of larger size and more brilliant plumage than the common variety found in Europe; but the probability is that they are only accidental, or at most caused by a more congenial climate; for it has been noticed that peacocks in the north of Scotland are inferior in point of beauty to those of the warmer parts of England; and it is known that those which are met with in Norway and Sweden are smaller in size, and less beautiful in plumage than in the south of Europe.

THE JAPAN PEACOCK (*P. muticus* of Linnæus) appears, however, to have some distinct characters. We might indeed expect this from the simple fact of its being a native of the Japan isles; for it should seem that there is nothing native in those singular islands, whether animal or vegetable, exactly like the productions of any other country, how much soever it may agree with them in its common generic characters. The Japan peacock is very nearly of the same size and general character with the common or Indian one; and like that, it has the tarsi armed with a spur on each. The crest, however, is of a different character, being composed of ten graduated feathers, which are reflected backwards. The cry is also different from that of the common species. We are not aware that any living specimen of it has been, at least of late years, brought to Europe.

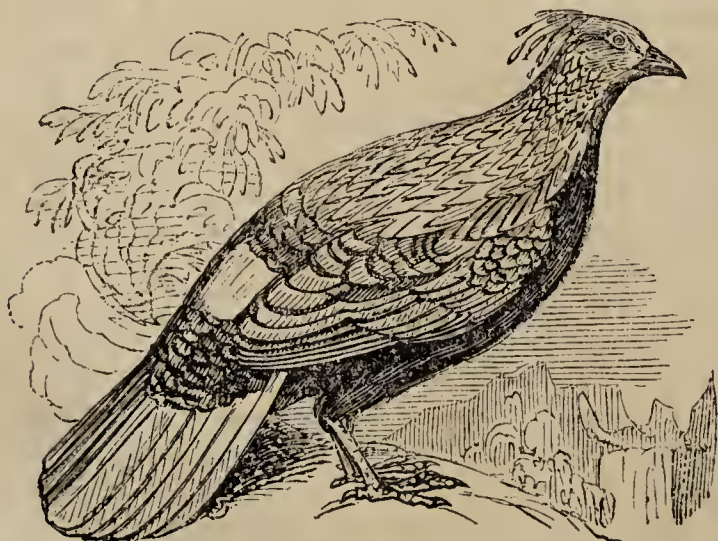
LOPHOPHORUS. This genus, which has no very accurate English name, is an inhabitant of the mountainous parts of the north of India. The characters are: the head surmounted by a crest, consisting of detached silky feathers of unequal length, and reflected backwards; the tail is rounded, and the coverts are

not produced, as in the peacocks; the colours of the male have a very brilliant metallic lustre; and the tarsi are furnished with spurs.

Lophophorus refulgens is about the size of a turkey. The general colour is black; but the crest and feathers of the back are relieved by very brilliant reflections of gold and bronze colour, and also bright blue and bright green; the tail-feathers are red. The prevailing colour of the female and the young birds is brown, clouded with grey and yellowish. The most remarkable character of these birds, and one in which they differ from all the rest of the order, is that of the bill, which is altogether a long one, and the upper mandible projects a considerable way over the under one, and is truncated at the tip. This mandible is much arched, very strong, and advances on the front of the head between the feathers. It has a strong rounded ridge all along the culmen, with a groove on each side. The under side of it is very much hollowed, and the upper mandible shuts so completely into it as to be invisible when the bill is closed. What particular purpose this singularly-formed bill answers in the economy of the bird has not been ascertained, but it must refer to some peculiarity in the food or the manner of feeding. The legs are rather short but very strong, and the feathers on the tibiae are so much produced as to hang down nearly as far as the spurs on the tarsi.

Lophophorus Cuvierii has the same characters of bill as the other species or variety; but the crest is pendent backwards, and the feathers on the upper part are margined with white. It is also smaller in size than the other, though larger than any of the pheasants. The feathers on the tibiae are also less produced. The female is less than the male, of a brown colour, and with white edges to the feathers on the breast.

Both these species belong to nearly the same locality, and both are mountain birds, found chiefly, if not exclusively, in the mountainous countries between India and China, not, we believe, on the more lofty ridges and summits of the Himalaya, but on the secondary hills and in the upland valleys. In the south of India, and even in Bengal, they are unknown as native birds; for even at Calcutta they are brought from the north, and esteemed as curiosities.



Lophophorus Cuvierii.

It does not appear indeed that there is, on the mountains within and near the tropics, any gallinaeous birds agreeing in character with the ptarmigan and other species of mountain grouse of the north. In air and appearance the present birds corresponds in part with the peacocks, in part with the common fowl, and in part with the pheasants; but they differ

so much from any one of these, that they are properly made a distinct species.

TRAGOPON. This genus was by the elder naturalists included among the pheasants, under the title of the "horned pheasant," from two appendages of the head to be afterwards noticed; and it was also called the Nepâl pheasant, from the country in which it was first discovered. In all its characters, and in its general air and appearance, it is, however, very different from the pheasants; and in the shape of the body, and the carriage of the head and neck, it much more nearly resembles a common fowl. The forehead and cheeks are almost naked; the hind part of the head has a crest of loose detached feathers inclining backwards; there is a slender horn sticking out behind each eye; and the wattles under the throat are capable of being extended. The upper parts of the male bird are bright red, spotted with white, the white being surrounded with a ring of black; and on the coverts of the wings and upper part of the tail those spots are larger and more distinctly eye-shaped than on any other part of the body. The neck and breast are orange, with white spots surrounded with black; and those spots become larger on the flanks and thighs.



Nepâl Horned Tragopon (Pheasant).

The quills and tail-feathers are brown, clouded with a darker shade of the same colour, and the tail is pointed and consists of eighteen feathers, the two parts folding upon each other as in the common fowl. The tarsi are long and strong, armed with short but sharp spurs in both the sexes, but the female is without the wattles and horny appendages, and of a brown colour. The naked parts of the feet are bluish white, the toes and claws long but not much arched, and the hind toe is articulated so far up on the tarsus as not to touch the ground in walking. The whole air of the bird, which is rather larger than the common fowl, is expressive of vigour, and that structure of the feet to which we have alluded points out that it is a swift runner, as these organs approach very nearly to those of some of the more flat-footed of the running birds. The habits are not much known, but the length of the toes would indicate that the bird frequents the margins of the waters, or otherwise upon soft and boggy grounds. Hitherto it has been found only in the north of India, but how far its geographical distribution extends we are uninformed. It does not appear, however, that there is any trace of it in central or in western Asia, though we want information respecting the natural history of those mountains which, extending from the Himalaya to the Altaian

ridge, divide the Chinese rivers from those that flow westward to the central lakes.

CREPTONYX—crested pigeon of Latham. The birds of this genus are of small size, not exceeding that of the common quail. They are inhabitants of India and the eastern islands, but they are hiding birds of the margins of the close jungles, and little is known of their manners. As this species (for there is only one species known with certainty) bears some resemblance to birds of several genera, it has been called by different names, such as the green partridge, the green grouse, and some others; but its generic characters do not warrant its union with any of these. The characters are: the bill stout, strong, and compressed; the two mandibles of equal length; the edges of the upper one straight, except a little curvature towards the point. The nostrils longitudinal, placed in the middle of each side of the base of the upper mandible, and partially covered with a naked membrane. There are three toes turned to the front, partially to their bases with a small membrane, and the hind toe is without a claw, articulated high on the tarsus, and does not touch the ground in walking. The tarsi are long, and without any spurs in the male; the wings are short, rounded, and hollow, the first quill is very short, and the fourth, fifth, and sixth are the longest in the wing. The known species,

Creptonyx cristata, inhabits the Sunda islands, and also many parts of the south of Continental Asia. The upper parts are of a bright green colour. Six black feathery bristles rise in the form of a ruff on the front; the top of the head is white, but furnished with long plumes of a reddish colour, which form a loose crest inclining over the occiput. The cheeks and neck are black; the coverts of the wings brown of various shades, varied with russet and black. The under parts are blackish violet; the bill greyish above and fawn-coloured on the under side; the irides yellow, and the feet fawn-coloured. The tail is of mean length, and carried flat, not folded together as in poultry. The female is of a dull green colour on the upper part; the naked skin round the eyes is reddish; the wings resemble those of the male, but are less bright in the colours. The under parts are blackish brown, and the feet are reddish. This last circumstance has caused the sexes to be described as separate species; but the truth respecting them is now pretty well ascertained. A smaller species of a red and yellow colour, between five and six inches in length, while the green one is about ten inches, has occurred as a museum specimen, and been reported to be from the Guzerat, or rather from that extensive tract of ground near the Runners of Cutch, which is seasonally flooded, and which is at other times so very rich in ground birds of various genera; but we believe nothing is known with certainty respecting this bird, as to even where it came from, or whether it be or be not an accidental variety.

The species which we have hitherto enumerated may be said to comprise one of the natural groups of the gallinidæ with regard to geographical distribution. In a native state they are not found to the westward of the Persian mountains, or of that cross ridge in central Asia to which we have alluded; for though the common pheasant is described as having been brought from Colchis, the probability is that it was an imported species there, and it does not appear to have been found in the west of Asia further to the south. Those Asiatic birds excel all the rest of the

order in the beauty of their plumage, in the form of their bodies, and in the boldness and pugnacity of the male birds, both in their affairs of honour and in defence of the females and young. There are differences of flavour and other qualities in the flesh; but all the species are not only eatable, but wholesome, and, generally speaking, superior. The more they are in a state of nature, the flesh has always a finer flavour, but it is more tender, and also more abundant when they are domesticated. There are also degrees of hardness among them, especially on their introduction into climates colder than their native ones; but still they are all what might be considered hardy birds; and there is probably no species of them but which might be introduced with advantage into all climates, excepting those which have the very extreme of severity. They are all polygamous; their broods are numerous; and as in polygamous animals, the number of females always exceeds that of the males; they are equally valuable for their eggs as for their flesh; and on both these accounts, as well as on account of their beauty, they are eminently deserving of attention. There still remain several genera to be noticed, as birds of the warmer climates of Africa and America, before we come to speak of those of the cold and temperate regions of the northern hemisphere.

GUINEA FOWL (*Numida*). This is originally an African species, or at least a native of the south west of Asia only, in addition to the African continent. It has however been pretty generally introduced into various parts of Europe, Asia, and America, as a domestic bird. In a domesticated state, the Guinea fowl (which is also called the pintado) is not so profitable as the common fowl, chiefly because the females are much less attentive to their young, and the number bred with the same labour is consequently smaller.

The characters of this bird are: The bill short and stout; the upper mandible curved, convex, arched in the culmen, and covered at the base by a warty membrane; there is a sort of earunculated wattle suspended from the under mandible, and the nostrils are placed in the membrane, at the base of the upper mandible, and half covered by cartilage; the head is generally naked, or thinly scattered with a few hairs, and with a strong callus, or horny crest. Some of the species however, which we shall notice afterwards, are distinguished by crests of feathers; the tarsi are smooth, and the feet have four toes, three to the front, which are united to their bases by a short membrane, and one in the rear articulated higher up on the tarsus than the front ones; the tail short, and drooping towards the ground, the external feathers on both sides being very short, and gradually increasing in length to the fourth on each side; there are at least three species, if we admit the possession of a crest of feathers as a sufficient distinction, and the common species, as is the case with most of the domesticated gallinidæ, is broken into several coloured varieties, which do not however appear to be deserving of particular notice, at least as species.

The common Guinea fowl (*N. meleagris*) has the body greyish blue, sprinkled with small white spots; head and upper part of the neck naked, a conical tubercle, with its tip reflexed on the crown, and a broad geminated membrane near the gape. One variety has the breast white, and another has the whole body whitish, with rounded white spots: other

varieties also occur, and a hybrid has been produced between a male pintado and a domestic hen. The young are pretty birds, somewhat resembling red partridges at an early age: the adult male is much larger than the common cock, and measures about twenty-three inches in length; the male has a loose wattle of a bluish colour, but that of the female is red. These birds in a wild state associate in numerous flocks, manifesting a partiality to marshy and morassy situations, where they subsist almost wholly on insects, worms, and seeds, laying about nine eggs, but breeding probably more than once in the year. In many of the scorching districts of Africa, in Numidia for instance, they fly in troops during the day, and perch at night on trees. They abound in the fertile plains of Arabia, according to Niebuhr, and are so numerous near Tahama, that the children knock them down with stones and sell them in the town. In the year 1508, vast numbers of them were transported to America by the Genoese; they have now so greatly multiplied, and become so habituated to the climate, that in the Spanish possessions they roam at liberty in the midst of the savannahs and woods. They sustain without injury the cold of our northern climates, notwithstanding the great heat of their native country, and might possibly be as successfully introduced into our woods and parks as the pheasant; but it is very troublesome to get them to incubate and rear the young in the poultry yard, as they frequently desert their charge, and drop their eggs under hedges, or in other concealed places. The hen pintado when sufficiently fed will lay about one hundred eggs, if care be always taken to leave one in the nest. The eggs of the pintado are smaller than those of the common fowl, of a rounder form, reddish white, obscurely freckled with a darker colour, and are considered a very delicious morsel. As ancient and modern epicures have boasted the flavour of this species, it has been reared for the table in all ages, and frequently by the intervention of the common, or of the turkey hen, either of which proves a more vigilant and careful nurse than the female pintado.

When Guinea fowl are kept in a domestic state, they do not seek their own food with the same assiduity as common poultry; and thus they require some attention in this respect, which adds to the expense of keeping. Once or twice a day they must be regularly supplied with food, which consists of buckwheat, barley, or millet; they eat when in the fields grasshoppers, worms, beetles, and ants, and cut up and destroy the tender buds and flowers. They eat considerably more than the common poultry, probably, in consequence of the shorter length of their intestines. A male pintado will serve for ten females. The female generally lays at the latter end of May or the beginning of June, and the eggs are usually from eighteen to twenty-four in number: the shell of the egg is of a yellowish white colour, spotted with small brown points, and is very hard; they are deposited by the female in a retired place, under some bush; she seldom sits with any assiduity, nor when the young are disclosed does she display any great affection for them; it is therefore found more profitable to have their eggs hatched by a common hen: the incubation lasts three weeks, or rather better. As we before hinted, the young are very delicate and difficult to bring up, requiring much attention in the article of food; they should be placed where there are insects, and in a dry situation. On the top of the

head, the casque, and the barbels of the lower jaw, are not distinguished before the birds are six or seven months old. Near the time these appendages begin to make their appearance, and the epoch is critical for the young pintados, they become liable to maladies, from which they cannot be preserved but by great care and proper nourishment. A considerable difference between the pintado hen and the common one is, that the intestinal tube is much shorter in proportion in the last, being but three feet long, without reckoning the cœca, which are six inches each: they proceed widening from their origin, and receive the vessels of the mesentery, like the other intestines. The largest intestine is the duodenum, which is more than nine lines in diameter; the gizzard is like that of the hen, and small gravel stones are found there, as in that bird; indeed, nothing else is found there sometimes, the consequence apparently of the animal having died in a languishing state, and passed the latter moments of its life without eating: the internal membrane of the gizzard is very much wrinkled, and very slightly adherent to the nervous tunic, and of a corneous substance, or something very analogous to it.

The crop is about the size of a tennis-ball when inflated; the intermediate canal between the crop and gizzard is of a harder and whiter substance than that part of the intestinal tube which precedes the crop, and does not exhibit nearly so great a number of apparent vessels: the heart is more pointed than it is commonly found in birds, the lungs are as usual; it has, however, been remarked in some subjects, that on blowing into the trachea, to put the lungs and air-vessels in motion, that the pericardium, which appears more loose than usual, became inflated as well as the lungs. In the cavity of the thorax, the trachea receives two small muscular cords, about an inch long, and two-thirds of a line broad, which are implanted there on each side. These two muscles adhering on one side to the bottom of the trachea, and on the other to the clavicles, are peculiar to all the species of gallinidæ; they serve to keep the trachea fixed to the middle of the aperture of the thorax: the lower part of the trachea, and the lower larynx of the pintados, differ very considerably from these same parts in cocks and pheasants. The entire tube of the trachea in the pintados, from the glottis to the distance of an inch from the lower larynx, is formed of complete rings, in the intervals between which are membranes. This part of the trachea is susceptible of being elongated or shortened by two pair of muscles, which accompany it through its whole length; but at the distance of an inch from the lower larynx the rings are broad, perfectly cylindrical, and soldered as it were one upon the other. On each side of this tube towards the lower part are five membranes, which are followed by three rings of the lower larynx, from which the bronchiæ depend. These last are formed of flat semi-rings, which gradually diminish in length: there are thus some imperfections connected with the Guinea fowl as an inhabitant of the poultry yard; but where elegance and variety, as well as mere profit, are objects of consideration, it can be advantageously introduced.

The crested Guinea fowl (*N. cristata*) is chiefly known as an African bird. It is less in size than the common Guinea fowl: the bill is horn colour, furnished at the base of the upper mandible with a bluish cerc in which the nostrils are placed. It has no carunculated appendage to the lower mandible like

the common species ; but there is at each side of that mandible a longitudinal fold, forming a sort of small appendage ; the throat, the upper part of the neck, and the hind portion of the head are denuded of feathers, and the naked skin is deep blue on the latter part and sides of the neck ; it is greyish blue in the region of the ears ; and it assumes a crimson tint toward the fore part of the neck. This species gets its name from a crest of feathers on the upper part of the head : the plumage is black, powdered over with very small spots of bluish white bordered with bright blue ; the neck and breast are black, and the crest on the top of the head is also black, and composed of downy feathers with their webs quite disunited : the wing-coverts are blackish brown, some of the secondaries being marked with four white rays, and others having their exterior webs bordered with black : the beak is ash colour, the cere bluish and smooth, and the naked membrane on the head and neck is thinly scattered with very delicate hairs. The length of the male bird is about eighteen inches.

This species is represented as inhabiting the hottest parts of the interior of western Africa, where they are said to be found in very large flocks upon the margins of the sandy deserts. One of these flocks consists of some hundreds, made up of many united broods ; for it appears that these birds, though when domesticated they do not agree well with the other gallinidæ, are yet very sociable with each other. Their numbers are so great that they make the deserts re-echo with their discordant cries. Towards the rising of the sun and close of day their piercing cries are most frequently heard : the manners of these birds are like those of the last and the following species, and they equally feed on all kinds of grains, worms, insects, and berries.

The *mitred Guinea fowl* is distinguished from the others by a horny crest or casque on the top of the head. Its manners and habits are similar to those of the common Guinea fowl ; its cry differs very little from that of that bird, and is equally discordant and continuous ; in size it is alike, measuring twenty-one inches ; its casque rises about an inch and a half above the top of the head, in the adult state ; but in the young birds it is less curved backwards, and less angular. There are no distinct wattles in this species, nor any fleshy appendage to the lower mandible, but merely two slight folds of skin, one directed from near the eye toward the gape, and the other from the same point down the side of the neck ; these, however, are but little produced, and therefore they are not very conspicuous. This species or variety has been found in the island of Madagascar, and it is pretty generally distributed over the continent of Africa, at least such is the opinion of naturalists.

We believe that we have now enumerated all the principal species, and most of the leading varieties of the gallinidæ of the eastern world, which may be considered as having their native localities confined to the southward of the central mountains of Asia, and the Mediterranean. They form as it were a southern division of the order in this hemisphere ; there is also what may be regarded as forming, in a geographical point of view, a middle latitude division, which are found in the wild state, in the same localities as one or another of those which have been described, and also in higher latitudes than any of the others are met with in a state of nature ; but before we advert to these, it will be necessary very shortly to notice the

southern division of those which inhabit the American continent, though from what we have already remarked in the articles *ALECTORIDÆ* and *CURASSOW*, we may confine our present notice to a mere enumeration of the species ; they all belong to the family

ALECTORIDÆ ; and fall under the following divisions :—

Ourax, the *pauri*. These birds are inhabitants of the warmer parts of tropical America. They are large birds, and when in a state of nature and undisturbed by human intrusion, they are very tame, on which account Buffon, and some others, have most incorrectly brought a charge of stupidity against the birds. This is very incorrect ; for though they are birds of gentle manners, very easily tamed, and capable of much attachment, when in a state of domestication, they are most attentive to their young ; and although in the openings of the wild woods they are quite unsuspicious, and allow sportsmen readily to get within shot of them, yet, when the neighbourhood becomes peopled, they become shy.

The male bird of this species measures about two feet ten inches in length, and in size and weight it very much resembles the domestic turkey. It has the bill very short and stout, and considerably hooked. This bill is covered with a membrane at the base, which extends a considerable way up the forehead, and is met by soft and tufted velvety feathers. In this naked membrane, immediately at the base of the bill, there is a tubercle, of an oval shape, about the same size as the bird's head. This tubercle is of a bright blue colour, and of the hardness of stone, on which account the French give them the name of the "stone birds." (*Oiseaux à pierre*.)

The species to which we allude (for there are more than one), is the *Crax pauri* of Linnæus. According to the accounts given by those who have good opportunities of observing, this bird nestles on the ground, and leads about its young, and calls them to it by a cry, much in the same manner as the pheasants. At first the young live on insects, and then, when they grow large, on fruits, grains, and, in fact, on every thing on which poultry can be fed. When in a state of domestication, and she has become well accustomed to the climate, the female brings up her little ones extremely well ; but it often occurs that great quantity of the eggs are abortive, which proceeds from not giving to these birds sufficient liberty. By fastening their wings, and leaving them a large space, shaded on one side, the broods will thrive extremely well. The eggs are white, and about the size of those of the turkey. The hen turkey may be employed both to hatch these eggs and educate the young, as the time of incubation is the same with both birds. The little ones are covered with a brown down, and the globe which should surmount the head is not apparent at this early age. After the first moulting it shows itself, by a small tubercle, which increases in proportion as the bird advances in age. Both the male and female are provided alike with this appendage, but, in the latter, it is somewhat smaller. The globular excrescence which we have mentioned as adhering to the base of the upper mandible, is of a bony texture in the adult birds, and ramified over with grooves. The interior is composed of small cells, which the bird appears to have the power of filling with air through an opening in the interior of the upper mandible ; though what purpose this curious appendage answers in the economy of the birds

nas not been explained. The young have it round ; but in the mature birds it rises up in a crown, and has some resemblance to a pear standing on the thick end, and is altogether about two inches and a half in height. One of the cries of these birds resembles the syllables *po-hic*, very loud and clear ; but they, in common with most of the family, also utter a humming or murmuring sound. The call is common to the two sexes, and it is clear and sonorous, and heard a considerable way off. In the male there are convolutions in the trachea, bearing some slight resemblance to what we meet with in some of the swans and other birds which dabble in the waters ; and this renders it probable that the cellular appendage to the bill may answer some purpose analogous to that of the enlargement of the bronchial end of the trachea in these other birds. After the trachea has followed the same direction with the gullet, as far as the entrance of the thorax, it returns upward, over the right great pectoral muscle, at some distance from the crest of the sternum, continues its direction over the entire length of this muscle, forms a curve there in passing to the distance of two lines behind the sternum, over the tunie which retains the entrails ; it then proceeds the length of two inches and a quarter over the left pectoral muscle, there makes a turn on the side of the sternum, passes anew behind this bone, above the first curve, then turns anew, follows its direction over the right pectoral on the side of the crest of the sternum, and passes over the right clavicle into the cavity of the thorax. There is a muscle on each side of the trachea, which serves to lengthen or shorten it. The tube adheres, in its entire length, to the pectoral muscle, by a very fine cellular tissue, and is immediately covered by the skin. The upper and lower larynx do not differ from the same parts in the peacock, but a very apparent soele is found at the bottom of the upper larynx, at the aperture of the glottis. The tube of the trachea is composed of slender rings, distant from each other about two lines. The spaces between the rings are membranous. It is understood that this convolution of the trachea is not wholly confined to the male bird, but occurs in the female also, though to a rather smaller extent.

One or two other species of this genus are mentioned ; but they do not require a very particular notice. They are :

Ourax mitu, which has been improperly confounded with the curassows. It has the upper parts black, with violet and purple reflections, but the margin of each feather dead black, without any reflection, the upper part of the head is covered with short velvety feathers, of dead black, and there is a crest of frizzled feathers, not very long, and of an intense black on the hind head and neck. The coverts of the wings are black, with white tips. All the under parts are brilliant black, with the exception of the belly and under-tail coverts, which are maroon brown. The feet are reddish, and the bill is red, surmounted with a horny casque of the same colour, which runs a little way upon the forehead. The irides are blackish. The length of the full grown bird is from twenty-eight to thirty inches. The young have the black colour less pure, the red in the bill and feet duller, and the casque on the bill less elevated.

Two or three other species have been mentioned, but they are known only as museum specimens, which have no interest for the general reader, and even these are a little confused. Indeed they are not often

seen by the European colonists, even in those countries which they inhabit, as they are much more shy than many of the other gallinidæ, and especially than the curassows. These last are found very generally in the court-yards in Brazil, in Guiana, and in Mexico ; but the pauxis are rarely seen there, nor are they very common in collections. They inhabit the vast forests with which so great a breadth of the fertile regions of tropical America is covered ; and as the only inhabitants of the open parts of those forests are the different tribes of Indians, who range the wild woods with much more ease than Europeans, the birds are chiefly sought after by them as game. With few exceptions, such as the cultivation of a little cassava and Indian corn, those wild tribes subsist entirely upon the produce of the forests ; and, aided by the *wourali* poison, and their bows and blowing tubes for throwing arrows and darts, they are very expert marksmen, and can bring down a bird, or arrest the speed of a land animal, with perhaps greater certainty than an European can do with his musket. The poison is of great service to them in this respect, because the least movement with the poisoned weapon very speedily throws the animal into a complete stupor, or kills it, if only a small one. The arrows and darts are so contrived, that the point which is armed with the poison, and of which the hunters keep a store, taking great care to preserve them from damp, is so contrived, that the moment it fastens in the body of an animal, the shaft or handle drops off, so that it may again and again receive fresh points, and bring down fresh game before the hunter takes the trouble of picking up the first ones. We believe that the birds of this genus are the game most highly prized by those Indians, though many of the larger species of parrots are also very good eating, and as they are more in sight than those birds of the deep forest, they fall more to the lot of Europeans in traversing the wilds.

PENELOPE (the *Guan* or *Yacou*). This is also a species inhabiting the tropical parts of America, chiefly to the south of the Isthmus, and between the Andes and the eastern sea. Guan, or quan, and yacou, are names given to it by the natives of those countries in which it is found. The systematic name, *Penelope*, is not very well chosen, because it has been applied to the widgeon, a bird which is very unlike the present genus ; and the widgeon again got its name from the Greek fable, of a red-headed duck having saved Penelope, the wife of Ulysses, from drowning when she was a girl. It does not appear that either the widgeon, or any bird of the present genus, ever practised so much gallantry ; as the names have been generally introduced, however, it would not be advisable to change them.

The characters of the present genus are, the beak of mean length, and nearly straight, depressed at the base, so that the breadth exceeds the height, and with the upper mandible sharp and curved at the tip. The forehead, a space round the eyes and the chin, are bare of feathers ; the nostrils are placed on each side of the bill, near the middle of its length, and have only a small part toward the front open ; the tarsi are slender, and not longer than the middle front toe ; there are three toes to the front, united by membranes at their bases, and one to the rear articulated much further up on the tarsus than the front ones. The first four girdles of the wings are gradually *staged*, or the one regularly longer than

the other, like steps; the fifth and sixth are the longest in the wings, which are, consequently very much rounded. They are also short, so that the birds are incapable of an extended flight. The naked part of the throat is furnished with a sort of wattle, the middle part of which is marked with warts or tubercles. The tarsi are covered with reticulated scales; and this, as well as the peculiar form of the bill, point them out as ground birds, inhabiting moist places and the margins of the waters. Their colours are subject to great variations, in different birds, and in the same bird, in different ages and at different seasons, so that it is exceedingly difficult to determine species and varieties, as difficult indeed as in the case of the common cock; and it is possible that the circumstance of having or wanting a crest may not form a specific difference in the one genus any more than it does in the other. When these birds take to the wing, their flight is near the ground, on the level, and of brief continuance. In the extensive and dense forests of those places in which they inhabit, they perch on the inclined branches of trees, and run so quickly by the aid of their short wings, that a man cannot overtake them. They pass the day concealed in thickets; but they are astir morning and evening, when they resort to the outskirts of the forests, without, however, entering into the open plains, or other exposed situations. They are easily reconciled to domestication; and they subsist on grains and fruits like the rest of the gallinaceous birds. But when they swallow Indian corn, they void grains entire. They may be reared with profit in the poultry yard, for their flesh is excellent; but they are averse to close confinement, and should be allowed to be much in the open air. They utter, in a shrill, but subdued, and nasal tone, the sound of *pec*. They construct nests of small twigs, which they carefully conceal in a close bush or tree near the ground. The eggs are generally about eight in number. They live in pairs, and also in families, which appear very much attached to each other, for if there are several found in a tree, they will remain till they are all shot one by one. When they perch, or otherwise repose, they support the breast on the folded legs. We shall briefly notice the leading species.

The Crested Guan (P. cristata). This species was long confounded with the turkeys, with which it has hardly any character in common, except that both are gallinaceous birds. It has also sometimes been called a peacock, to which it has if possible still less resemblance. Buffon gave it the name of *yacou*, which we believe is what it is called by the Aborigines of Brazil, while guan or quan is its native name in some other parts of South America. The upper parts are blackish green, with metallic reflections of olive and bronze colour. The rump and tail-coverts are deep red. A black streak extends from the angle of the lower mandible to the ear. The cheeks are in great part naked and of a bright red colour. There is a small crest of loose feathers on the hind part of the head; and a large pendent wattle hangs from the gorge which is of a fine red colour, and capable of being elongated and contracted according as the bird is excited or not. This appendage is nearly double the size of that on the throat of the turkey; but the bird has the power of withdrawing it so completely, that it scarcely differs from the naked skin of that part to which it is attached. The breast is of an olive colour, and the rest of the under

parts reddish, the margins of the feathers on both being white. The bill is black at the tip and blue at the base, the naked skin round the eyes violet, the iris orange, and the feet are ash-coloured. The length of the full grown male is about two feet and a half. The female is rather smaller, less bright in the colours, and has the feathers on the head, the crest, and the scapulars, bordered with white. The young birds have the head and neck completely covered with reddish downy feathers; three stripes of maroon brown also of downy appearance, one large one along the head and upper part of the neck, and a smaller on each side. The upper parts are deep red clouded with paler, and the under parts are reddish white. In this stage of its growth it has been described as a separate species; but it is now well ascertained to be only the young of this one.

The male in this species, as is the case in many others of the *Alectoridæ*, has a flexure of the wind-pipe. After having accompanied the gullet to the anterior part of the sternum, the wind pipe, or trachea, rises over the right pectoral muscle; but it advances only two inches in that direction and repasses over the same muscle, and reaching along the crest of the sternum, enters the cavity of the thorax and proceeds toward the lungs. The rings of cartilage in this organ are separated by pretty broad membranes; and toward the larynx it opens like a funnel. The larynx is attached to the process of the *os hyoides*, or bone of the tongue, and consequently it is connected with that organ, as in the parxi, the turkey, and the peacock, while in the common cock, the curassow, and the different species of pheasants, the larynx is not supported by the bone of the tongue, but merely attached to the membranes of the gullet. This difference of structure in the upper larynx of the trachea has a considerable influence on the intonation of voice in the birds; as those which have it fixed to the tongue, are incapable of the same flexibility and clearness of utterance as those which have it free. It must be understood, however, that in birds, the lower or bronchial larynx is the real organ of voice, that is the organ at which the sound they make originates; though of course this original sound is modified by the nature of the tube through which it passes, and also by that of the upper orifice from which it is communicated to the air and rendered audible. A convoluted trachea gives depth to the note of birds, in the same manner as a long tube gives depth to any other wind instrument; and it is also evident that one which is capable of much motion in its several parts, or has one part wider than another, must roughen the sound, and in this bird the last effect is further increased by the upper larynx and surrounding parts being covered by tubercles. We are not, however, to suppose that the peculiar structure of the trachea in these birds is confined to the mere modulation of the sounds which they utter; for these are but a very secondary part of their economy. But they inhabit regions which are seasonably flooded to a very great extent; and though their haunts are not then explorable, it is highly probable that they feed under water, in the shallows, for as they are ground feeders, they cannot well feed anywhere else at those times; and therefore the convoluted and extended trachea in them may enable them to keep the head longer immersed, just as it does in those dabbling birds which have it formed in this manner. But the wilds of the forests

in tropical America are not very explorable at any season, and when flooded they are forbidden grounds, so that we have no means of knowing the conduct of the ground-feeding inhabitants at those times, farther than by analogy, and the analogy is rather loose, as no other countries have exactly the same physical characters.

The Whitting or Hissing Guan (*P. pipile*) varies more in colour than even the former one, and therefore descriptions of it founded on colour are apt to be more contradictory. The upper parts are black with metallic reflections of purple and violet. The nape is furnished with a crest of long thread-like feathers, which are white with black shafts. There is a large white band on each side of the neck. The greater and middle coverts of the wings are white with black tips and shafts. The under parts are black with some streaks of white on the breast. There is a small naked space on the cheek of a blue colour, and the pendent wattle on the throat is also blue. The quills of the wings are black with metallic reflections; the feet are red, and the bill bluish at the base and black at the tip. The full grown male measures about twenty-eight inches. The female is rather smaller in size, and less bright in the colours; and has the feathers of the crest mottled with black and white. The young are of a maroon brown colour, with the naked space round the eyes leaden grey. The feathers in the crest are shorter than in the mature birds, and also brown.

This species ranges from Guiana to Paraguay, and from the base of the Andes to the shores of Brazil; and in a bird extending over so wide a territory, we may expect considerable climatal differences. Accordingly individuals have been mentioned as occurring in Brazil, in which the webs of the quills do not extend the full length of the shafts, but leave a portion of these naked like a spine. Some individuals have been kept in confinement in Europe, in which state they were very quiet and inoffensive birds. The sound emitted by this one is a sort of hissing whistle, not nearly so loud or harsh as that of the former species; and the authorities state that the trachea goes straight to the lungs without any convolution.

The Marail Guan (*P. marail*). This species is called the green pheasant in Guiana. It is a well distinguished species, and remarkable for the brilliant metallic lustre of its plumage. The upper part is rich blackish green; the crest, which is large and tufted, is very bright green, with white margins to the feathers; and there is also a band of small silky feathers of a bright green colour, that extends from the lower mandible at the gape to the eyes, and these feathers have white margins as well as those of the crest. The nape, the upper part of the neck, and the breast are also bright green, with white margins to the feathers. The coverts of the wings are iridescent green, and the quills black. The under parts, the belly and the under tail-coverts are brownish fawn colour; the bill black, and the naked parts on the sides of the neck and the appendage to the throat are very clear bright red, thinly scattered over with black hairs. The feet are reddish and the claws black. It is smaller than the other species, being only about twenty-six inches in length when full grown. The colours of the female are less brilliant than those of the male, and her whole plumage has a slight reddish tinge. The young in

the early stage are covered all over with downy feathers of a russet colour.

According to Sonnini this species of guan is very easily tamed, and so familiar in a state of domestication, as to be absolutely troublesome. It soon knows those people who are about it and kind to it; and it is so fond of being caressed that it runs about their feet, and is in danger of getting trampled on, or tumbling them down in their attempts to avoid it. It utters cries of persuasion similar to those uttered by a common hen when she collects her chickens. When in a state of nature it is a quiet and gentle bird, frequenting solitary places, and feeding chiefly upon wild fruits. In their general habits they almost constantly perch upon trees, though they feed on the ground. Their short and hollow wings are ill adapted for forward flight, which they make with even more labour and noise than a common barn door fowl; but they leap to their perches or from them with considerable ease and agility, and they run very swiftly, making use of their half expanded wings to row them along, as is the case with ostriches. In many of their habits they approach more nearly to the jungle fowl of India than to any other of the native gallinidæ of South America. In many of their habits, as well as in their generic characters, they differ from these. The males are monogamous, and show no disposition to fight or quarrel with each other, or indeed with any other creature. They live generally in pairs, and shun the society not only of all other birds, but of each other, except the pair and the family during the first year. The female makes her nest in trees, and the eggs vary from two to five. In the morning they are very early birds, and their cry is heard as the dawn is breaking; but though loud it is hoarse and disagreeable. During the day, however, they are seldom heard, and in their native haunts in the forests, they are very seldom seen.

The hoarse voice of this species appears to arise from the convolutions of the trachea, which are somewhat different from those of the crested guan, and approximate more to the wood-grouse and the spoon-bill: the texture of the organ is nearly the same in both, being composed of rings alternating with membranous partitions; it ascends along the neck as far as the union of the coracoid bones, then it passes into the interior on the left side of the gizzard, returns in front of the left coracoid, as far as the furcal bone, at its union with the sternum, where it returns back again and proceeds to the lungs. The anterior part, which extends forwards, has a peculiar muscle attached to it, by which it is secured to the crest of the sternum and also to the pectoral muscles.

Though the number of eggs in this species is less than that of some of the others, they hatch twice in the year, in December or January, when the rainy season commences, and in May or June, when it is over. The nests are carefully concealed in thick bushes; and, different from many of the gallinidæ, the mother feeds them for some time in the nest. This lasts for about two weeks, by which time their feathers have begun to sprout; and the mother descends with them, and tends and feeds them on the ground, until they are so far fledged as to be able to perch. Their first food consists of insects, small seeds, and fruits, for which the parent bird scrapes the ground in the same manner as the common hen; she also calls them to her by similar cries, and gathers them under her wings for

shelter or protection. The young are very easily tamed, and they readily find their way back to a home in which they have been fed and otherwise kindly treated; but they are not fond of passing the night within doors, preferring a perch on trees, if there are any in the neighbourhood.

THE PARRAQUA (*Ortalia*). This genus has been confounded both with the former and with the true pheasants; but its characters are sufficiently distinct from both. They are very noisy birds, and the name parraqua is nearly expressive of their cry: with the true pheasants this bird has few characters in common, and it is easily distinguished from the genus *Penelope*. The culmen of the bill is more elevated and curved, and the tip more enlarged and arched. There are no elongated naked appendages to the throat, and very little naked skin, only a narrow band extending downward from each corner of the gape; the space between these stripes is covered with black skin, not feathered but beset with hairs. The upper parts are mottled with grey, green, and red; the front, the top of the head and the upper part of the neck are deep red; the coverts of the wings are red, with the exception of six of the middle ones, which are iridescent green, and the quills are of the same colour, but not so brilliant. The lower part of the neck and the breast are olive grey; the bill black but greyish at the tip; a bluish circle of naked skin around the eyes, and the feet reddish; the length is about twenty-two inches. The young are smaller in size, and have the red spots on the upper parts more conspicuous, while the under part is brownish, with grey margins to the feathers. These birds construct their nests on small and tufted branches, at about seven or eight feet from the ground; they lay from four to six eggs. When the young are disclosed they descend in a short time from the nest, and the mother conducts them in a similar manner to the common hen. The usual aliments of these birds vary very much; but when young, and having just quitted the nest, their food principally consists of worms and small insects, which the mother procures for them by scratching up the earth: they quite abandon the mother when they are grown large and are able to fly. Besides fruits, seeds, and in all probability, insects, these birds occasionally feed upon the young and tender grass, with which the savannahs begin to be covered after they have been watered by the rains. The feeding time is early in the morning, before the heat of the sun becomes strong; for after that they retire to the shelter of the woods, and as they seek the cover of the very thickest foliage, it is with difficulty that they can be seen during the day; but in the evening, when it begins again to get cool, they come out of their hiding-places, and utter their loud and harsh cries: they feed a second time in the evening, and when light fails them, they return to their perches in the trees. They are found in the western valleys of the Colombian states, as well as in the valleys of the larger rivers further to the east and south. Humboldt in his travels among the ridges of the Northern Andes and their spurs, found them in the deep and romantic valley of the Magdalena, perched in flocks of sixty or eighty upon the withered trees, and making the neighbourhood to resound with their harsh and piercing cries.

The trachea of the parraqua is more convoluted than that of the crested or the marail guan: it passes over the left coracoid nearly the entire height of the

great pectoral muscle, doubles back nearly the length of this muscle along the external surface of the peritoneum, and is reflected forward, divides, turns backward, and proceeds to the lungs. Humboldt measured the length of this tube both in the male and the female; and the difference is so great, that were the fact not known to be otherwise, they might be taken for different species. The difference of the bodies of the birds is not more than an inch or two in length; but the convoluted trachea of the male is nearly three times as long as the unconvoluted trachea of the female; the former measuring fifteen inches and a half, and the latter only five and a half.

HOAZIN (*Opisthocomus*). This is a bird of the same countries with the *Alectoridæ*, but it unquestionably belongs to a different family. Doubts were at one time entertained as to its existence; and now that the fact of there actually being such a bird is well established, its place in the system has become a little puzzling. It was first described by Fernandez as a Mexican bird, about the same size as a turkey, standing higher than the curassow, and of a different form and air: it was described as having a tufted crest of feathers, white on the one side, and black on the other, a curved bill, the breast yellowish white, and the wings and tail marked with dark spots and stripes: the back, the neck, and sides of the head of a rusty brown colour, and the feet dull raven grey. The same writer added, that its voice, which bears some resemblance to the sound of its name, is very powerful, and resembles something between a croak and a howl: he adds that it inhabits the deep forests, and perches upon trees near the banks of the waters, waiting for serpents, which constitute the chief part of its prey: the same author mentions a smaller bird somewhat similar, but feeding differently, and eatable, though by no means delicious; the other being altogether unfit for this purpose. It does not appear that there is much truth in any of these statements; and it is probable that Fernandez confounded together two birds of very different species, the one an aquatic fishing bird, and the other some such bird as the one under consideration, though very imperfectly known to the describer. Later writers have been induced to class this genus with the omnivorous birds; but it does not appear, at least from any thing that is known, that it partakes much of this character. There is, however, only a shade of difference between some of the omnivorous birds and some of the gallinidæ; for of the former some are easily tamed, and of the latter not a few are very miscellaneous in their feeding: it is probable that when this bird comes to be better known it may be found to require a distinct place.

The generic characters are, the bill short and stout, convex in the culmen, curved and compressed laterally towards the tip, but enlarged at the sides towards the base, and with the lower mandible strong and angular at the point. The nostrils are placed in the middle of the surface of the bill, and partially covered above with a membrane; the feet are stout and muscular, with short tarsi, and four toes, entirely divided to their bases, and with the two lateral ones unequal, and all bordered with rudimental membranes: the middle toe is as long as the tarsus or longer, the wings are of mean length, concave and rounded, the first quill being very short, the next four increasing by regular stages, the sixth being longest in the wing: the tuft on the head is composed of narrow feathers, which are red in the basal half, and black in the distal

When the bird is in a state of repose they hang down as far as the middle of the neck ; but when it is excited it can raise them so that they stand out from the hind head. At the same time it expands the tail in a fan-shape, and, in fact, it has some of the air and gait of the peacock, but differs much in colour.

There is only one known species, the *sasa* of Sonnini, the "crested pheasant" of Latham, and *Opisthocornus cristatus* of Illiger, the last of which names is retained by Cuvier, who remarks justly that Vieillot gives a very inaccurate representation. The upper parts are of a blackish-brown colour : the top of the head is reddish, furnished with a crest of feathers, coloured as already noticed : the back of the neck is blackish, with a white line on the shaft of each feather : the larger and middle coverts of the wings have white tips, the lesser coverts have their exterior webs white, and their interior brown : the first four quills of the wings are wine-red with brown points ; those next them are bordered with brown in their outer webs, and those next the body are altogether blackish-brown : the tail-feathers are greenish-black with white tips : the chin is brown, the lower part of the neck and the breast are reddish-white, the rest of the under parts wine-red, and the bill and feet brown : the length is about twenty inches.

The manners of this species are unknown ; and it should seem that the birds themselves are not very abundant. Sonnini mentions that there are but few in number in those parts of Guiana through which he travelled. Occasionally he has met them in small flocks, not exceeding six or eight in number. He never found them in the deep woods or in elevated situations ; but on the inundated savannahs and other marshy places, where he did not observe them on the ground, but on the leaves of the arborescent arum (*Arum arborescens* of Linnæus), which grows to the height of five or six feet, and is very plentiful in the marshes of the tropical countries. It is on the succulent berries of this arum that these birds are described as having been chiefly seen feeding. This is a little singular, and shows that there is a consumer provided for almost every substance. The milky juice of this arum is of so acrid a nature as to blister the hands of those who touch it ; and yet, according to the accounts, these birds make the plant their constant habitation and their regular food, eating the leaves and flowers at those times when there is no fruit upon it. The same author, to whom we are indebted for the only exact description of the bird, whether it be or be not the hoazin of Fernandez, further mentions that they are always found perched on the trees in the marshes, and that they repose in pairs close to each other. Their voices are loud and harsh, and bear so much resemblance to the word *sasa*, that the natives of Guiana know them by that name. In the same trees, or rather arborescent plants, they form their nests, externally of small branches, and internally lined with down ; the last of which is certainly not a custom with any of the common gallinaceous birds. The hatch consists of five or six eggs ; but the state of the young has not been very particularly examined. The flesh of these birds has so strong a flavour of musk as not to be at all relished by Europeans, and we believe that it is not much, if at all, eaten by the natives. It is worthy of remark, that in this musky flavour it agrees with the flesh of the mammalia and reptiles which inhabit the waters of tropical America and their borders.

The genera of which we have now given some slight account, but respecting many of which more accurate information would be highly desirable, comprehend nearly the whole of the gallinaceous birds which are found only in the tropical parts of the American continent. With very few exceptions, and those apparently exceptions of mere variety, they are all larger than the races of the same order which inhabit the southern parts of the eastern continent. Their plumage is also of a more sombre character, though, in many of the species, the glosses, and even the tints, are exceedingly rich. The appendages to their heads and necks will also be observed to be peculiar, and more unlike what we are accustomed to in the native birds of Europe, than any thing which occurs in the genera of the south and the east. We may also add that, taking them as a whole, their manners are much more gloomy ; they have not the same briskness and spirit, and their flesh is very inferior in an economical point of view.

There is still one genus which, though it resembles the quails in some particulars, and is included by Cuvier in the grouse family (*Tetraonidæ*), may be mentioned here for the sake of including in one arbitrary division the same geographical locality. This species is

TINAMOUS (*Crypturus*). The characters of this genus are : the bill straight, slender, depressed, broader than high, and blunt, and rounded at the extremity. The upper mandible enlarged on the upper part, and margined at the tip. The nostrils placed in the middle of the bill, in long nasal grooves, oval in their shape, and open. The legs are rather long, and the tarsi are often furnished with hard tubercles on the hinder edges. There are four toes, entirely divided, all of them rather short, and the hind toe reaching the ground in some species, but not in others. The claws on the toes are small and flattened. The wings are short and rounded ; the first four feathers increase in length by regular stages ; and the fifth and eighth are the longest in the wing. The tail consists of ten feathers. It is short in all the species, and merely rudimental in some of them, on which account the name *crypturus*, "obscure tail," is applied to the genus.

It will easily be inferred from the characters which we have described, that those birds are very different in their habits from the other gallinidæ of the warmer regions of America. The shortness and roundness of their wings render them incapable of long flights, and the shortness of the tail or the want of it unfits them for ascending and descending with the same ease as the perching birds, which, whatever may be the character of their wings, always have the tail well formed. Their structure points out their peculiar habitat, which is the wide and extended plains, or the margins of the forests, but not the forests themselves. They are found as far north as Mexico ; and also in Guiana, but they are much more numerous in Brazil, and in the plains of Paraguay. There they are found in vast numbers, living and multiplying much in the same manner as partridges ; though, as the physical circumstances of their native country are different from those of many of the places which partridges inhabit, we may expect corresponding differences in their structure. Accordingly they run with much greater swiftness than any of the partridge tribe ; so that in their speed they bear some resemblance to little ostriches ; and in the course of the

year they range over no inconsiderable extent of surface. This becomes necessary; for during the latter part of the dry season the produce of their pastures is exhausted, and during the rains a considerable extent of those pastures is laid under water. Neither the one nor the other of those circumstances occurs in the same district at the same time; so that the birds have a sort of seasonal movement between the higher and the lower grounds. From their being obliged to walk more vigorously and migrate further than the partridges of the eastern continent, the flesh of the old birds is not so tender as that of partridges. Still, however, they are much esteemed, and eagerly hunted by the *guassows* or peasantry of South America. They are naturally unsuspicious, and not afraid of the hunters, who thus procure them in great numbers. They indeed disperse themselves during the day; but they assemble in flocks during the night. They form their nests of dry leaves under the bushes, in a very rude manner; and some idea of their fertility may be formed, when it is stated that they breed twice in the year, and have from fifteen to twenty in a hatch. They eat all manner of seeds, small fruits, berries, and insects; but though they often resort to the woods and copses in search of these, they do not perch or pull them from the bush, as they pick them up from the ground, that being their proper feeding place; and they scrape the earth in the same manner as poultry. The soil, in such a country as South America, affords a rich pasture for *rasorial*, or scraping birds, because the heavy rains beat down a number of seeds and other matters, and so incorporate them with the soil, that they require to be scraped out. Altogether, though there is a resemblance between this genus of birds and the partridges, both in form and in use in the economy of nature, yet it is impossible to help admiring the beauty and perfection with which each is adapted to her peculiar diversity, and suited to the peculiar physical character of its own country. Nor is it unworthy of remark, that the small mammalia which inhabit nearly the same places of South America, as the tinamous, are also all feeders on the ground, and the greater number of them are burrowing animals, which scrape the earth not merely for the purpose of forming habitations, but for that of finding them food, at least at certain seasons. The reader who wishes to see more of this analogy between the ground birds and the ground mammalia of the dry plains of South America, may compare what has been now said with what will be found noticed in the articles *ARMADILLO* and *CHINCHILLIDÆ*, in their places in the alphabet in a former part of this work. There are a good many species of this genus, of which we shall give some short notice:—

Crypturus magoua. This species has been called Brazilian; but it occurs in perhaps equal abundance in other parts of South America. The ground colour all over is olive-brown, slightly striated across, with black above, greyish red beneath; crown rufous; the secondary quills transversely striated with rufous and black. Size of a common fowl. About eighteen inches in length; the body more compact and thicker than that of the pheasant. The birds of this species inhabit Brazil and French Guiana, where they roost on the low branches of trees, two or three feet from the ground. The female lays from twelve to fifteen eggs, of the size of those of a hen, and of a beautiful green colour, in a nest formed on

the ground, among the thick herbage, and carelessly composed of moss and dried vegetables. The young run, almost as soon as they are hatched, after the mother, and hide themselves on the least appearance of danger. Their cry, which is a sort of dull whistle, may be heard a great way off. Many of them are shot, and many caught, when roosting on the trees. The flesh and eggs are esteemed great dainties.

Crypturus rufescens, the reddish tinamou, called also the *guazu*, has the ground colour greyish red, transversely, striped with black and white above, margin of the wings rusty red; region of the ears black, breast pale yellowish red, waved with brown beneath. Sides and abdomen greyish. Fifteen inches and a half in length. This bird is a native of Paraguay, and the most beautiful of its family residing among thick herbage, which it seldom quits, except on the point of being trampled on or struck with a stone. Its cry, which is heard at a considerable distance, is a lugubrious whistle. The female conceals her rude nest among dry stalks, in a tuft of grass or under a bush, and the eggs are said to be not quite so numerous as those of the former species. The eggs are of a delicate violet colour, and of nearly equal thickness at both ends. When these birds are alarmed they erect the feathers on the head, something in the form of a crest. They are found in Brazil as well as in Paraguay.

Crypturus nanus, is a small species found also in Brazil and Paraguay. The upper parts are of a brownish colour, with the extremities of the feathers on the back and rump black, and beautifully waved with greyish white. These last feathers are, in some specimens, very much enlarged, and have reddish spots of red between the black ones. The top of the head is mottled with red and grey, with the middle of the feathers black; the cheeks and sides of the neck are greyish ash colour, with black borders to their feathers. The nape and upper part of the nape brownish ash with black centres. The small and middle coverts are reddish cream colour, rayed with black, and with large white spots; the quills black, with rust-coloured borders to their outer webs; the throat and middle of the under part are whitish, with obscure black streaks; the breast is cream-yellow, streaked with brown; the feathers on the rump are loose and downy, and form a sort of silky tuft; the bill is brown, with the base of the lower mandible yellow, and the feet are yellow. The full grown male of this interesting little species is only about six inches in length. The female is an inch shorter; the colours incline more to red, and the black spots on the upper part are not nearly so conspicuous.

Crypturus obsoletus is another species found in the same localities with the last-mentioned; but it is larger in size. The upper parts are blackish-brown, clouded with red; the top of the head and the upper part of the neck blackish-ash; the sides of the neck and the throat reddish-ash; the back of the neck, the breast, the flanks, and the belly, are bright rust-coloured red; and the feathers on the flanks and belly are produced so as to clothe the thighs; their ground colour is rust-red, and they are strongly rayed with black. The feathers of the tail are exceedingly short, and entirely hidden by the coverts. The bill and feet reddish-brown. The length of the full grown male is about eleven inches and a half. The female is smaller and duller in the colours. This is described as a very swift-footed species.

Crypturus noctivagus. This is a Brazilian species, and gets its name from its habit of stirring and uttering its cry during the night, or, at all events, very early in the morning and very late in the evening. The upper part is dull greyish ash, clouded with brown and reddish and streaked with black. The top of the head and the rump are rusty brown, and the coverts blackish brown. The throat is whitish, the breast pale rose colour, and all the rest of the under part russet. The bill brown, with the base of the under mandible whitish and the feet brownish ash. The full grown male is between thirteen and fourteen inches in length.

There are about as many more known species as those which we have mentioned; and it is probable that there are several others which have hitherto escaped observation; but none of them appear to differ so much from each other as that a further enumeration would be interesting to the general reader. The vast number of species, however, and the fact of the whole of these species being confined to the American continent southward of the isthmus of Darien, are worthy of notice, as indicating the peculiar state of nature in the greater number of her productions in that part of the world. They are indeed so unique, so different from those of other countries, even from those of Africa, Holland, and the eastern islands which have the same latitude, that they especially recommend themselves to every one who wishes to study the relations which subsist between a country considered in its structure and meteorology, and the organised beings; whether animal or vegetable, which that country produces.

We have next to mention an American genus, which, in an economical point of view, and for the purposes of domestication, is certainly more valuable, upon the whole, than any other, except common poultry, and, in the individual bird, far more valuable than even these. If we except the potato, this bird must be regarded as by far the most valuable natural production of the American continent which has been introduced, and, to a great extent, naturalised in Europe. We need hardly say that we allude to

MELEAGRIS, the turkey; neither need we give any long description of the external appearance of a bird of which there is but one species, that species generally known, and more rarely breaking into varieties than any other with which we are acquainted.

The generic characters are: the bill short and thick; the head and upper part of the neck covered with a naked skin, beset with tubercles; the throat furnished with a longitudinal pendulous and knobby wattle, which is partially covered with hairs. There is also a conical fleshy knob, thinly scattered with hairs on the tip, and it arises from the junction of the bill with the forehead. When the bird is in a state of repose, and not disturbed nor alarmed, this appendage is short; and when the bird is strongly excited, it enlarges till it covers the whole bill, and hangs two or three inches over its tip. The neck is of moderate dimensions, both as to length and to thickness; and to the lower portion of it there is attached an appendage of a fleshy texture, furnished at the end with a brush of hard black hairs, about nine inches long.

There is, as we have said, but one species, the common turkey (*Meleagris gallo-pavo*), which is a favourite bird in our farm yards, though much inferior to what it is in a state of nature; and, indeed, those

who have seen only the domestic bird in Europe, even in those places where it seems to thrive best, can have no idea of the splendour of its appearance in a state of nature. The male is then, when full grown, little less than four feet in length, and at least five in the extent of the wings. The body is thick, rather lengthened, and covered with feathers, which are very abrupt at their terminations. The webs of these feathers at the basal part consist of sooty-coloured down, beyond which they are dusky, and terminate in a broad band of rich metallic lustre, the colours of which are very varied when the light falls variously upon them—changing from bright golden colour, through different shades of copper, bronze, violet, and purple. On the back the feathers have, beyond this, a terminal band of velvet black, without any reflections. The metallic glosses are richest on the upper parts of the back, and the black deepens towards the rump and tail-coverts, though on the latter there is a broad band of bright coppery lustre, and a slight bay margin beyond the velvet band; and the last ones have more of the bay colour, crossed with narrow bars of metallic green. The feathers on much of the under part are dark, and glossed with reflections, but of less intensity than those on the back. The wings are hollow and rounded, and do not reach beyond the insertion of the tail. They consist of twenty-eight quills each, of which the first is very short, and the fourth and fifth the longest in the wing. The coverts next the scapulars are like the feathers on the body; those next the quills are copper and violet, beyond which there is a black band and a whitish tip. The bastard wing, the coverts of the primaries, and the primaries themselves, are blackish, banded with white; the second are white, banded with black, but with a trace of rusty yellow, which increases on the tertiary quills, and is there marked with some metallic reflections. The tail is composed of eighteen hard and strong feathers, of a rust colour, mottled with black, crossed by narrow lines of the same colour, and with a broad black bar nearly at the tips. These tail-feathers are very strong, and more than fifteen inches in length in the full grown bird when in a state of nature; so that when the tail is spread out like a fan, as the bird is excited, and parades, struts, and wheels about, the tail, though it wants the rich tints and light and airy spread, like that of the peacock, is far from being destitute of grandeur. The legs and feet are very stout and rather long, the tarsi measuring about six inches. They are covered with imbricated scales of a five-sided shape, and have a strong and compressed, but rather blunt, pointed spur on the insides. The three front toes are connected at the base by a membrane, the middle one being about four inches in length, each of the lateral ones about two inches, and the hind toe, which touches the ground only with its tip, is about one inch in length. The female is considerably smaller; and the head and neck are covered by irregular feathers of a dull grey colour. The feathers on the back have the tips rusty; the tubercle over the bill is merely rudimental, and the tuft on the lower part of the neck is generally wanting altogether. There is, however, a concealed rudiment of it, and when the females become barren, which is said to be pretty frequently the case with the wild birds, this appendage makes its appearance, though it is always much more slender than in the males. The hunters who are engaged in the capture of wild

turkeys learn to distinguish such birds, and select them with great care, as they are reckoned finer food than either the males or the fertile females. At one season of the year, generally about the month of March, both of these, and more especially the males, become so lean, that they are hardly fit for the table, while, at this season, the barren females are understood to remain in as prime condition as at any other. What proportion these barren females, which there is some reason to suppose are more numerous in this genus than in any of the others, may bear to the total number of the birds, has not been ascertained; but it would almost appear as though a natural provision were made in this race of a surplus for human food, in the same manner as a similar surplus is often obtained by artificial mutilation in domestic poultry, and in some other animals.

When America was first discovered, the wild turkey was found in abundance along the whole range from Canada to near the isthmus of Darien, though it does not appear ever to have been met with further to the south; and even in Mexico it was less plentiful, and of inferior quality, clearly indicating that its true home is in the temperate latitudes. The absurd name of "turkey" is given to it only in England; and it originated in the time of Henry VIII., when every thing of foreign production which was highly esteemed, had the same epithet given to it. It even found its way into the Latin dictionaries, as *Gallus Numidicus*, as if it had come from the north of Africa; and so prevalent was the error that the eminent naturalist Ray, and after him the honourable Daines Barrington, described it as a native of Africa, and the tropical parts of Asia, whereas it is not found in either of these quarters of the world, neither is it a tropical bird.

The settlers in North America, appear to have been much more intent upon killing the wild turkeys, and cutting down their favourite forests, than in attending to their natural history, or inquiring whether they might not have been profitably preserved in a country which, like the United States, must continue, comparatively at least, thinly peopled for ages.

It is now rare in the southern states, Florida, Georgia, and the Carolinas; very rare in the states of the centre of the Union; and in the north-east it has been extinct for a century and a half. The western states on the Mississippi, and its affluents, where the woods are still remaining, are now the head quarters of these birds in a state of nature; and it is not supposed that the birds are at all known in the elevated parts of the Rocky Mountains or the country beyond. We shall here make an extract of the account of their manners in the wild state, as given by, or rather to, Prince Charles Lucien Buonaparte, as it is the most circumstantial that has appeared, and as the turkey is known with us only as a domestic, and, in fact, as a degenerate bird.

"The wild turkeys," say these describers, "do not confine themselves to any particular kind of food; they eat maize, all sorts of berries, fruits, grasses, beetles, and even tadpoles; young frogs, and lizards, are occasionally found in their crops; but when the pecan nut is plenty, they prefer that fruit to any other nourishment; their more general predilection is, however, for the acorn, on which they rapidly fatten. When an unusually profuse crop of acorns is produced in a particular section of country, great numbers of turkeys are enticed from their ordinary haunts in the

surrounding districts. About the beginning of October, while the mast still remains on the trees, they assemble in flocks, and direct their course to the rich bottom lands. At this season they are observed in great numbers on the Ohio and Mississippi. The time of this irruption is known to the Indians by the name of the *turkey month*.

"The males, usually termed *gobblers*, associate in parties, numbering from ten to a hundred, and seek their food apart from the females; whilst the latter either move about singly with their young, then nearly two-thirds grown, or, in company with other females and their families, form troops, sometimes consisting of seventy or eighty individuals, all of whom are intent on avoiding the old males, who, whenever opportunity offers, attack and destroy the young, by repeated blows on the skull. All parties, however, travel in the same direction, and on foot, unless they are compelled to seek their individual safety by flying from the hunter's dog, or their march is impeded by a large river. When about to cross a river, they select the highest eminences, that their flight may be the more certain; and here they sometimes remain for a day or more, as if for the purpose of consultation, or to be duly prepared for so hazardous a voyage. During this time the males gobble obstreperously, and strut with extraordinary importance, as if they would animate their companions, and inspire them with the utmost degree of hardihood; the females and young also assume much of the pompous air of the males, the former spreading their tails, and moving silently around. At length the assembled multitude mount to the tops of the highest trees, whence, at a signal note from a leader, the whole together wing their way towards the opposite shore. All the old and fat ones cross without difficulty, even when the river exceeds a mile in width; but the young, meagre, and weak, frequently fall short of the desired landing, and are forced to swim for their lives; this they do dexterously enough, spreading their tails for a support, closing their wings to the body, stretching the neck forwards, and striking out quickly and forcibly with their legs. If, in thus endeavouring to regain the land, they approach an elevated or inaccessible bank, their exertions are remitted, they resign themselves to the stream for a short time, in order to gain strength, and then with one violent effort escape from the water. But in this attempt, all are not successful; some of the weaker, as they cannot rise sufficiently high in air to clear the bank, fall again and again into the water, and thus miserably perish. Immediately after the turkeys have succeeded in crossing a river, they for some time ramble about without any apparent unanimity of purpose, and a great many are destroyed by the hunters although they are then least valuable.

"When the turkeys have arrived in their land of abundance, they disperse in small flocks, composed of individuals of all sexes and ages intermingled, who devour all the mast as they advance: this occurs about the middle of November. It has been observed, that, after these long journeys, the turkeys become so familiar as to venture on the plantations, and even approach so near the farm-houses, as to enter the stables and corn cribs in search of food; in this way they pass the autumn, and part of the winter. During this season great numbers are killed by the inhabitants, who preserve them in a frozen state, in order to transport them to a distant market. Early in March they begin to pair; and, for a short time previous, the females

separate from, and shun their mates, though the latter pertinaciously follow them, uttering their gobbling note. The sexes roost apart, but at no great distance, so that, when the female utters a call, every male within hearing responds, rolling note after note, in the most rapid succession; not as when spreading the tail and strutting near the hen, but in a voice resembling that of the tame turkey, when he hears any unusual or frequently repeated noise: when the turkeys are numerous, the woods from one end to another, sometimes for hundreds of miles, resound with this remarkable voice of their wooing, uttered responsively from their roosting-places. This is continued for about an hour; and, on the rising of the sun, they instantly descend from their perches, and the males begin to strut, for the purpose of winning the admiration of their mates.

"If the call be given from the ground, the males in the vicinity fly towards the individual, and, whether they perceive her or not, erect and spread their tails, throw the head backwards, distend the comb and wattles, strut pompously, and rustle their wings and body feathers, at the same moment ejecting a puff of air from the lungs. Whilst thus occupied, they occasionally halt to look out for the female, and then resume their strutting and puffing, moving with as much rapidity as the nature of their gait will admit. During this ceremonious approach, the males often encounter each other, and desperate battles ensue, when the conflict is only terminated by the flight or death of the vanquished. This pugnacious disposition is not to be regarded as accidental, but resulting from a wise and excellent law of nature, that always studies the good of the species, without regard to the individuals. Did not females prefer the most perfect of their species, and were not the favours of beauty most willingly dispensed to the victorious, feebleness and degeneracy would soon mark the animal creation; but, in consequence of this general rule, the various races of animals are propagated by those individuals who are not only most to be admired for external appearance, but most to be valued for their intrinsic spirit and energy.

"When the object of his pursuit is discovered, if the female be more than one year old, she also struts, and even gobbles; she turns proudly round the strutting male, and suddenly opening her wings, throws herself towards him, as if to terminate his procrastination. But should he meet a young hen, his strut becomes different, and his movements are violently rapid; sometimes rising in air, he takes a short circular flight, and on alighting, drags his wings for a distance of eight or ten paces, running at full speed, occasionally approaching the timorous hen, and pressing her until she yields to his solicitations. Thus are they mated for the season, though the male does not confine himself exclusively to one female, nor does he hesitate to bestow his attentions and endearments on several, whenever an opportunity offers.

"One or more females, thus associated, follow their favourite, and roost in his immediate neighbourhood, if not on the same tree, until they begin to lay, when they change their mode of life in order to save their eggs, which the male uniformly breaks if in his power, that the female may not be withdrawn from the gratification of his desires. At this time the females shun the males during the greater part of the day; the latter become clumsy and careless, meet each other

peacefully, and so entirely cease to gobble that the hens are obliged to court their advances, calling loudly and almost continually for them. The female may then be observed caressing the male, and imitating his peculiar gestures.

The cocks, even when on the roost, sometimes strut and gobble, but more generally merely elevate the tail, and utter the puff, on which the tail and other feathers suddenly subside. On light or moonshining nights, near the termination of the breeding season, they repeat this action, at intervals of a few minutes, for several hours together, without rising from their perches. The sexes then separate; the males, being much emaciated, cease entirely to gobble, retire and conceal themselves by prostrate trees, in secluded parts of the forest, or in the almost impenetrable privacy of a canebrake. Rather than leave their hiding-places, they suffer themselves to be approached within a short distance, when they seek safety in their speed of foot; at this season, however, they are of no value to the hunter, being meagre and covered with ticks. By thus retiring, using very little exercise, and feeding on peculiar grasses, they recover their flesh and strength; and when this object is attained, again congregate, and recommence their rambles.

"About the middle of April, when the weather is dry, the female selects a proper place in which to deposit her eggs, secured from the encroachment of water, and, as far as possible, concealed from the watchful eye of the crow: this crafty bird espies the hen going to her nest, and, having discovered the precious deposit, waits for the absence of the parent, and removes every one of the eggs from the spot that he may devour them at leisure. The nest is placed on the ground either on a dry ridge, in the fallen top of a dead leafy tree, under a thicket of sumach or briars, or by the side of a log; it is of a very simple structure, being composed of a few dried leaves. In this receptacle the eggs are deposited, sometimes to the number of twenty, but more usually from nine to sixteen; they are whitish, spotted with reddish brown, like that of the domestic bird. Their manner of building, number of eggs, period of incubation, &c., appear to correspond throughout the Union, as I have received exactly similar accounts from the northern limits of the turkey range to the most southern regions of Florida, Louisiana, and the western wilds of Missouri. The female always approaches her nest with great caution, varying her course so as rarely to reach it twice by the same route; and on leaving her charge, she is very careful to cover the whole with dry leaves, with which she conceals it so artfully as to make it extremely difficult, even for one who has watched her movements, to indicate the exact spot; hence few nests are found, and these are generally discovered by fortuitously starting the female from them, or by the appearance of broken shells, scattered around by some cunning lynx, fox, or crow. When laying or sitting, the turkey hen is not easily driven from her post by the approach of apparent danger; but if an enemy appears, she crouches as low as possible, and suffers it to pass. A circumstance, related by Mr. Audubon, will show how much intelligence they display on such occasions: having discovered a sitting hen, he remarked that, by assuming a careless air, whistling, or talking to himself, he was permitted to pass within five or six feet of her; but if he advanced cautiously, she would not suffer him to come

within twenty paces, but ran off twenty or thirty yards with her tail expanded, when, assuming a stately gait, she paused on every step, occasionally uttering a chuck. They seldom abandon their nests on account of being discovered by a man, but should a snake, or any other animal, suck one of the eggs, the parent leaves them altogether. If the eggs be removed, she again seeks the male and recommences laying, though otherwise she lays but one nest of eggs during the season. Several turkey hens sometimes associate, perhaps for mutual safety, deposit their eggs in the same nest, and rear their broods together.

“When the process of incubation is ended, and the mother is about to retire from the nest with her young brood, she shakes herself violently, picks and adjusts the feathers about the belly, and assumes a different aspect; her eyes are alternately inclined obliquely upwards and sideways; she stretches forth her neck, in every direction, to discover birds of prey or other enemies; her wings are partially spread, and she softly chucks to keep her tender offspring close to her side. They proceed slowly, and, as the hatching generally occurs in the afternoon, they sometimes return to pass the first night in the nest. While very young, the mother leads them to elevated dry places, as if aware that humidity during the first few days of their life would be very dangerous to them, they having then no other protection than a delicate, soft, hairy down. In very rainy seasons wild turkeys are scarce, because, when completely wetted, the young rarely survive. At the expiration of about two weeks the young leave the ground on which they had previously reposed at night under the female, and follow her to some low large branch of a tree, where they nestle under the broadly curved wings of their vigilant and fostering parent. The time then approaches in which they seek the open ground or prairie land, during the day, in search of strawberries and subsequently of dewberries, blackberries, and grasshoppers; thus securing a plentiful food, and enjoying the influence of the genial sun. They frequently dust themselves in shallow cavities of the soil or on anthills, in order to clean off the loose skin of their growing feathers, and rid themselves of ticks and other vermin. The young turkeys now grow rapidly, and in the month of August, when several broods flock together, and are led by their mothers to the forest, they are stout and quite able to secure themselves from the unexpected attacks of wolves, foxes, lynxes, and even cougars, by rising quickly from the ground, aided by their strong legs, and reaching with ease the upper limbs of the tallest tree. Amongst the numerous enemies of the wild turkey, the most dreaded are the large diurnal and nocturnal birds of prey, and the lynx (*Felis rufa*), who sucks their eggs, and is extremely expert at seizing both parent and young: he follows them for some distance in order to ascertain their course, and then, making a rapid circular movement, places himself in ambush before them, and waits until, by a single bound, he can fasten on his victim.”

As already mentioned, the turkey was introduced into England in the early part of the sixteenth century. It came first from Mexico to Spain, and then from Spain to England in 1524, and it soon spread over the other countries of Europe, at first as curiosities, but afterwards as articles of food. Who was the first to feed on a turkey in the British islands has

not been recorded, but in France it was first served up at the nuptial feast of Charles IX. in 1570, about forty years after its first introduction into that country. It is probable that by this time the numbers had considerably augmented; and, though the fact is not established by evidence, it is probable that the general stock of European turkeys are from those that came from Mexico, and their being inferior in Mexico to what they are in North America, that is in the valley of the Mississippi, may in part account for the decided inferiority of the European ones, which applies to quality, and still more to weight. Wild turkeys, weighing between twenty and thirty pounds, are mentioned as not being unfrequent; while we believe those of Europe do not exceed the half of that weight.

It is worthy of remark, as showing the general difference between the physical condition of the two continents, and the adaptation of its own natural productions to each, that, while the cock of the Indian jungles, and the pheasants and other gallinidæ of the warmer countries of south-eastern Asia, which have been introduced into our climates, have not deteriorated it, but have been improved by care, at least in some of the species, the turkey, which is a native of temperate climates in America, and even of climates which have their winter as severe as it is in Lapland, should not have stood the change so well. It seems, however, that the turkey is more a bird of wild nature than the gallinidæ of the south-east; for even in the United States those which are kept in a domesticated state are inferior to the wild ones, both in size and in beauty of plumage. In some parts of that country, where wild ones are still to be met with in the neighborhood, we believe it is customary to improve the breed by procuring the eggs of the wild ones, and hatching them under the domestic; and as a turkey hen may, by proper management, be made to continue sitting until she has hatched two broods or even three, one hen may, if the eggs can be procured, hatch a number of these half wild ones in the course of one season, if they are removed and reared by hand as soon as they are hatched.

In this country the rearing of turkeys requires more care than that of any other bird in the poultry yard; and some attention is necessary in order to preserve the eggs. In Europe these are laid in the spring, and are generally from fourteen to eighteen in number; white is the general colour, but freckled with yellow and reddish. The hens naturally seek obscure places, where their eggs may be safe from the male bird, as he is very prone to destroy them. The hen also is sometimes known to destroy her own eggs, although in general she is a very persevering sitter. It appears, however, from various accounts, and among the rest, from an anecdote related in the Memoirs of the Academy of Stockholm, that the cock turkey is not incapable of performing the duties of a nurse. M. Carlson remarks on this occasion, that the total neglect of their young, ascribed to male birds that associate with a plurality of females, is not general. Geese are of this description, and yet the gander protects the young with the greatest care. But the instance of a turkey cock sitting on eggs seems the more singular, because both in a wild and tame state the males are accustomed to destroy the nests of the females, in order that they may have them sooner free for pairing; and, for this reason, the cock is carefully separated from her while she is hatching. In some temperate and warm countries

the hen also lays eggs in the autumn, which are generally used in cookery, as a brood is seldom perfected from them ; whereas, those deposited in spring not being more numerous than the mother can hatch, are usually allowed to remain under her care. The young require to be watched with attention, as they are liable to perish from hunger or redundant moisture. In this island they are bred in great numbers, in Norfolk, and some other counties, whence they are driven to the London markets in flocks of several hundreds, the attendants managing them with great facility by means of a bit of red rag tied to the end of a long stick, which, from the antipathy which they bear to that colour, effectually answers the purpose of a scourge. The quality and size of those reared in Norfolk are reckoned superior to those from any other part of the kingdom.

It is sometimes said that though the turkeys reared in Scotland are of smaller size than those of England, they are proportionally fuller of flesh, and in better condition. What degree of abstract truth there may be in this we cannot say ; but it agrees with the analogy of the birds in their native condition in America ; for those of the southmost and warmest part of the range, are less full of flesh and much tougher than they are further to the north. A turkey certainly rates higher in comparison with a goose in Scotland than in the south of England ; but there are two ways in which this may be accounted for—the superiority of the turkey or the inferiority of the goose ; and both of these are so equally applicable, that it is impossible to decide between them.

The genera which we have noticed in the geographical section immediately preceding, are wholly American birds, just as those which we noticed in the first geographical section were wholly birds of the eastern continents ; and it is not a little remarkable that the American section of the gallinidæ should be chiefly confined to that part of the continent which has the least chance of having had any natural interchange of productions with any other part of the world, but of which the inhabitants are all tempered to the peculiarities of the country itself. If natural history were to be followed out to its geographical arrangement, America southward would make a very distinct province, and present very peculiar and well defined features ; and, even in the present state of our knowledge, and totally as, till within these few years, the geography of animals has been neglected, the peculiarities of this part of the world force themselves on the attention of even the least observant.

We are now to proceed to what may, upon the whole, be considered as the gallinidæ of the great northern geographical province of the world ; and as in the high latitudes, the east of Asia, and the west of America, are not farther from each other than Norfolk is from the coast of Holland, we may naturally expect an interchange and consequent similarity in their native animals. There are differences no doubt, which are sufficiently striking for being specific in most cases, and even generic in many ; but still the whole may be said to belong to the same natural families ; nor are we aware that there is in Polar America any bird, or even any species of mammalia, to which there is not something in the northern parts of the eastern continent so nearly corresponding that they may be considered as the same in all their more prominent and more important characters, and similar in all their leading habits.

This is especially the case with that family of the gallinidæ which remains to be considered, which Cuvier retains as the Linnæan genus *Tetrao* (grouse), but which he divides into sections or sub-genera, and others divide into separate genera under distinct names. The best way perhaps, therefore, in order to make popular description meet the views of both parties, would be to consider these birds as a family, consisting of grouse, properly so called, and of birds resembling grouse ; and thus the proper name for the whole would be

TETRAONIDÆ. The only general character which Cuvier mentions as applicable to the whole of these birds, is that of having a band of naked skin over the eye, and this band generally of a red colour, the tint being rich in proportion as the birds are in high condition. This family, in one or other of the numerous genera and species which compose it, is very generally distributed over the globe ; and with the exception of South America, where their place is occupied by the tinamous, already described, they are found in every land of any considerable extent, and some of them in pretty remote islands of the sea. In some instances they are domesticated ; but, generally speaking, they are in a state of free nature. They are very abundant and prolific in all places which are adapted for them ; their flesh is both delicate and richly flavoured, and therefore they are highly prized for the table. On this account they are much hunted as game in all parts of the world ; and in the British islands they are the only wild and native birds which are recognised as game.

They admit of subdivision into three very distinct genera, or perhaps subordinate groups, and some of these groups admit of farther subdivision, before we come to species. These groups are, *Grouse*, properly so called, *Partridges* and *Quails*. If we take them according to their general distribution in latitude, we may perhaps say that the quails inhabit the most southerly ; the partridges next ; and the grouse, in one or other of their species, the most northerly—indeed, among the most northerly of land birds which remain in the same localities throughout the year. They are, however, often found incorporated together in the same latitude, though not exactly in the same locality. The quails, true to their geographical distribution, inhabit lowest down, where the climate is warmest ; the partridges in the champaign countries, which are a little more elevated, though it is not easy to draw a definite line between them and the quails ; and the grouse inhabit the greater elevations ; and as they are among the last resident birds near the pole in latitude, they are also in more temperate countries, where they are found in such, the last birds near the sky. We shall not, however, notice them in their usual arrangement, which is usually taken from grouse as the typical genus to the quail ; or in the geographical one from the quail to the grouse, which we have now mentioned ; but shall begin with the partridge, as the best known in common localities, and the one which is most generally distributed.

PARTRIDGES (*Perdix*). The characters of this genus are, the bill short, stout, compressed, and naked at the base ; the upper mandible arched, convex, and much curved toward the tip ; the nostrils at the base of the bill lateral, and half covered by an arched membrane ; the three front toes united by membranes as far as the first articulation ; the tail, consisting of

fourteen or eighteen feathers, is short, rounded at the extremity, and drooping downwards; and the wings are also short, rounded, and hollow. Partridges are stationary in some countries, and shift their abodes with the seasons in others. They are very numerous in warm and temperate regions of the globe, living in pairs, and steady in their family attachments. The greatest number reside in the fields and in open tracts of country, with the exception of some, which prefer the outskirts of woods in the neighbourhood of water. Their food consists of grain, seeds, bulbous plants, insects, and worms. They run more frequently than fly, get up from the ground with some difficulty, and make a whirring noise when on the wing. They have numerous broods generally; and the young, as soon as they are hatched, run about—indeed, they may be often seen running with a portion of the shell adhering to their bodies. The species and varieties of partridges are very numerous, so that we can afford to notice only a few of the *leading ones*.

The partridges of the eastern continent admit of subdivision into two sections:—the *true partridges*, which have the bill and tail short, and no produced spurs on the tarsi; and the *francolins*, which have the bill and tail produced, and spurs on the tarsi. The former are strictly monogamous, and fight few battles of mere gallantry, though they fight stoutly for their pastures; but the second are very pugnacious in some of the species. As a whole race they inhabit warmer latitudes than the true partridges. We shall notice them in order, and first the *true partridges*. Besides these there is a third division, the *Colins*, or partridge of North America, which are perchers, having the bill short and stout, and some of them are migratory.

The Common or Grey Partridge (P. cinerea). The male of this species, when full grown and in good condition, weighs about fifteen or sixteen ounces, and the female about two ounces less; the length of the entire bird thirteen inches, breadth twenty; the eyes are hazel; the bill in the young is brown, in the old bluish white; the legs also are yellowish when young, and, as they increase in age, turn to a dark bluish white. The age of partridges is discovered by the bill and legs; and another method is, from the appearance of the last feather of the wing, which is pointed after the first moult, but in the following year is quite round. The general colour of the plumage is brown ash, elegantly mixed with black, and each feather is streaked down the middle with buff-colour; the chin, cheeks, and forehead are tawny, and palest in the females. Under each eye there is a spot, with small warty excrescences, and above and behind the eye, towards the ear, is a naked skin of a bright scarlet, which is not very conspicuous, except in old birds; the legs of the male are furnished with a blunt spur or knob behind, and the breast with a crescent of a deep chestnut colour, which takes place the beginning of October; this mark the female wants, and her feathers are in general not so distinct and bright. It is said the partridge, if unmolested, lives from fifteen to seventeen years; others dispute this computation, and maintain that they live seven years, and give over laying in the sixth, and are at their full vigour when two years old. Partridges pair about the third week in February, and sometimes after being paired, if the weather be extremely severe, they all gather together, and again form the

covey. They begin to lay about six weeks after being paired. According to Ray there are one-third more male than female partridges hatched; and it is well known the old cocks will drive the young cocks off the ground, and afterwards frequently fight until they kill each other. In this respect partridges differ from pheasants; they will have a certain range to themselves, whilst pheasants will hatch and live quietly with their broods close together. When too many birds are left, these contentions are sure to happen; and the consequence is a scanty produce, for the female is so pursued, that she drops her eggs in various places, forming no nest, and perhaps never laying two eggs in the same spot. So well aware was the duke of Kingston of this circumstance, that he always had the partridges netted upon his manors as soon as they were paired, and destroyed all the surplus cocks. Mr. White, the naturalist of Selborne, relates that a friend, who was fond of setting, used frequently to take small coveys of partridges, entirely consisting of cock-birds; these he pleasantly, and not inaptly, used to term Old Bachelors. The late Mr. Doughty of Seiston, who was an excellent and most observant sportsman, once preserved an overstock of old partridges, and declared that he did not believe, for two seasons following, there was a covey of young birds upon a tract of near three thousand acres of as fine breeding land as any in the kingdom; he shot, and encouraged the destruction of this stock of ancients by all possible means; and the result was, that the partridges bred again as abundantly as formerly. The amorous nature of partridges has given rise to very strange accounts; we are unprepared to controvert, and less inclined to investigate, this peculiar propensity ascribed to them. The female lays her eggs on the ground, scraping together a few bents and decayed leaves, which are strewn roughly in the hollow made by an ox or horse's foot. This nest is formed upon hedge-banks, in corn or grass, but more particularly in clover fields; and the number of eggs laid are from fifteen to twenty-five, of a greenish-grey colour: the number of eggs is much reduced when the bird is either very young or very old, and also when the first eggs have been destroyed and a second hatch produced. There have, however, been instances of amazing fecundity in the partridge. On a farm occupied by Mr. Pratt, near Ferling, in Essex, in the year 1793, a partridge nest was found in a fallow field with thirty-three eggs; twenty-three of the eggs were hatched, and the birds went off; four more had live birds in them: the number of the eggs was ascertained before hatching, to decide a bet laid by a person who refused to credit so unusual a production; the female covered all the eggs; seven of which in the centre were piled in a curious manner. A nest was found in 1798 at Elborough, Somersetshire, in a wheat field, with twenty-eight eggs. In June, 1801, at Welton-place, Nottinghamshire, the seat of Mr. Clarke, a partridge's nest was found in a plantation, containing thirty-three eggs.

Upon Sion-hall farm, in Essex, belonging to Colonel Hawker, in 1788, the following extraordinary incident of a partridge depositing her eggs, was known to many persons. This bird chose the top of an oak pollard to make her nest; and this tree, too, had one end of the bars of a stile, where there was a foot-path, fastened into it; and by the passengers going over the stile, before she sat close, she was disturbed

and first discovered. The farmer, whose name was Bell, apprised us of the circumstance, which he laughed at, as being the report of his workmen, and saying that it was only a wood-pigeon they had mistaken for a partridge. But Master Bell, who had killed some hundreds of partridges, so positively affirmed his having beheld the bird upon the nest on the tree, and also, at another time, having told the eggs to the number of sixteen, that he was persuaded to ride to the spot, where the partridge was seen sitting. In a few days she hatched the sixteen eggs, and her brood scrambling down the short and rough boughs which grew out all around from the trunk of the tree, reached the ground in safety. The female sits three weeks, and during that period undergoes a considerable moult, for the feathers of the belly drop: the great hatch is about the first ten days in June; the earliest birds begin to fly towards the latter end of that month.

Partridges are not every year equally plentiful: in general, when the season is dry during May and June, the birds are numerous; on the contrary, heavy and frequent rains during the time of laying and incubation, may chill or drown the eggs. If the weather is wet when the young first leave the shell, the cold benumbs the little strength they then possess in their legs, and they die whilst the mother is leading them in search of food to sustain life. At this time too much drought is likewise unfavourable; the ground cracks from the heat, and into these crevices they fall and inevitably perish; and this latter spreads a more universal destruction than the former, especially in clayey lands. The old partridge has other dangers to encounter from weasels, stoats, &c., crows, magpies, curs, and shepherds' dogs; all of which suck the eggs, not to mention the shepherds and farmers themselves, who, in some counties, very *kindly* destroy them. It is not, under all these disadvantages, an unfair calculation to suppose that one half of the broods in any one year are never reared. When the eggs are destroyed in any of the above ways, the partridges frequently lay again, and the produce of these second hatchings constitute those small birds that are not perfectly feathered in the tail until the beginning of October, and always continue a puny, sickly race, that seldom outlive the rigours of the winter. The affection for its young, which the partridge shows, is peculiarly strong and lively; by her mate she is greatly aided in the care of rearing them; together they lead them out, call, and point out to them their proper food, and assist them in finding it, by scratching the ground with their feet: they frequently sit close to each other, covering the young with their wings like the hen; in this situation they are not easily sprung, nor will the sportsman who is attentive to the preservation of his game, disturb a scene so interesting; but should the pointer come too near, or unfortunately run in upon them, there are few who are ignorant of the confusion which ensues. The male first gives the signal of alarm, by a peculiar distressful cry, throwing himself at the same moment more immediately in the way of danger, in order to mislead the enemy; he flies, or rather runs along the ground, hanging his wings, and exhibiting every symptom of debility, whereby the dog is decoyed, by a too eager expectation of an easy prey, to run further from the covey. The female flies off in a contrary direction, and to a greater distance, but soon after secretly returning,

she finds her scattered brood closely squatted among the grass; and, hastily collecting, she leads them from the danger, before the dog has had time to return from his pursuit. Mr. Markwick says he has seen, when a kite has been hovering over a covey of young partridges, the old birds fly up at the kite, screaming, and fighting with all their might to preserve their brood. It is no uncommon thing to introduce partridges' eggs under the common hen; when she has set the regular time, if the young do not appear, the feathers are glued to the inner surface of the shell, from being exposed to too great heat from the hen. To remedy this, dip the eggs five or six minutes in water, and the moisture will soak through the shell and loosen the feathers; and this kind of bathing may also, perhaps, refresh the young bird, and give it additional strength to break its prison. It is said that the partridge, bred under a hen, retains through life the habit of calling when it hears the clucking of hens. The first food for the young partridges should be the eggs of the small ant; afterwards fresh eurds, mixed with lettuce, chickweed, or groundsel. It will be some time before they can eat grain readily.

Even when fostered by hand, the partridge seldom forgets its wild origin, and, at its full growth, soon acquires a habit of estranging itself from the house, however intimately it may have been connected with the place and its inhabitants, in the early stages of its existence. This species of partridge is very generally distributed over the eastern continent, most abundantly in the temperate regions, though it also occurs in high latitudes, and, seasonally at least, in hot countries, such as Egypt, and the coast of Barbary. In a bird which is so generally distributed, considerable varieties of colour may be expected, and two of these varieties have sometimes been described as separate species: these are the Damascus partridge, which is only about half the size of the common variety, pale ash colour above variegated with black and red, and yellowish white on the under side; and the hill partridge, which is smaller than the common variety, and darker in the colour. These and some others can be regarded as little else than climatal varieties, and there are instances also of albinos, or specimens nearly or altogether white.

The Red-legged or Guernsey partridge (P. rufus), is larger than the common one; and the following are its characters: the bill and irides are red, the forehead is grey-brown, the hind head is red-brown, the chin and throat white encircled with black, to which is added a band of white over each eye to the hind head; the forepart of the neck and sides of it are cinereous, with two spots of black on each feather, the hind part of the neck red-brown, the back, wings, and rump greyish brown; the breast pale ash colour; belly, sides, thighs, and vent red; the sides marked with similar streaks of white, black and orange; quills grey brown, with the outer edges yellowish; the tail composed of sixteen feathers, the four middle ones grey brown, the next on each side the same, but rufous on both sides; the legs are red, and the male only has the blunt knob or spurs behind them. This species is abundant in the south of France, and generally in the warmer parts of the south of Europe; and it is probable that it may be a climatal variety of the Greek partridge, which is very abundant in Greece, in the islands of the Archipelago, and in the west of Asia. It is not understood as being a native of any part of the main land of Britain;

but it is common in the isles of the channel, and it is on this account that it has got the name of the Guernsey partridge. It has been introduced into various parts of the south of England, with different success in different instances, though in many parts it is now fully established. It is generally reported that when the red-legged partridge establishes itself, the grey partridge disappears, and it probably is driven off by the stranger, which is the larger and more powerful bird. It is doubtful, however, whether the exchange be a wise one. The red-legged partridge is certainly larger than the common partridge, and it is also a more handsome bird; but it is questionable if its flesh is as good for the table; it is whiter in the colour than the flesh of the grey partridge, but it is inferior in flavour and not so juicy. It seems indeed to be a law in wild birds, that those which have the flesh exceedingly white have it with less flavour: it is also a much less social species than the last; and the same degree of union does not exist among its flocks. The male does not partake in the incubation, and leaves the care of the family entirely to the female: she forms her nest in the fields and bushes, and lays from fourteen to eighteen eggs, of a dirty yellow, marbled with large red spots, and powdered over with small ash-coloured points.

THE GREEK PARTRIDGE (*P. saxatilis*). The upper parts of this species are bluish grey, the front and naked skin round the eyes black, the cheeks, throat, and upper part of the neck pure white, divided by a band of black; the scapulars and principal coverts ash colour with yellowish tips; the top of the head and sides of the neck ash grey; the flanks furnished with grey feathers, crossed by alternate bands of black and white, and reddish brown at the terminations; all the under parts yellowish, fourteen ash-coloured feathers in the tail, the five lateral ones on each side with red tips; and the bill, a small circle round the eye; and the feet red. The length of the male bird is about fifteen inches. The colours in the female are less bright. This species, if species it be, and not merely a variety, differs from the Guernsey partridge in nothing but in being rather larger, and more inclining to ash-colour: it is found in the south of Europe, and also in the west of Asia, in which last country and in Greece it is very abundant; and in some places the people engage the males in pitched battles. There are several other partridges mentioned as occurring in the south of Europe, but they have no great claims to popular distinction. The rock partridge, for instance, is very like the Guernsey; and, indeed as the character of the ground changes, there are considerable changes in the partridges. This holds in Asia as well as in Europe, where the red partridge, or Greek partridge especially, appears to be broken down into a number of varieties. We shall merely mention one or two of the names:—

Hey's Partridge occurs in Arabia, and also in Nubia and Upper Egypt. Upper part clear grey ash clouded with cream-colour; head reddish ash; wing-coverts cream-colour, finely streaked with brown; quills brown marked with white on their outer webs; tail-feathers rather long and reddish; under part reddish brown, beak yellow, feet ash-coloured; length only eight inches.

Yellow-bellied Partridge. Inhabits west of Africa, south of the Desert. Upper part deep grey, marked with black and red; under part the same colour, unbroken except by a yellow band across the belly;

bill ash-coloured; feet yellow; length about nine inches.

Eyed Partridge. An Indian species. Fore part bright red; back banded with black and white; rump marked with triangular spots of chestnut; wing-coverts olive with black spots.

From the specimen which we have given of those foreign partridges, and if mere differences of size and colour were to be made grounds of specific distinction, the list might easily be extended to several dozens. There is, however, no interest for the general reader in such distinctions, because the main character of the birds and their manners vary little, notwithstanding those modifications of external appearance; and when the character and habits of one species or one variety, such for instance as the common grey partridge, has been well explained, it will answer for all the rest excepting in the very trifling circumstances of locality and colour.

THE FRANCOLINS need not detain us long. We have already mentioned that their enlarged bills, longer tails, and spurs on the tarsi distinguish them from the true partridges; and that it is generally these birds, and not the real partridges, which are engaged in pitched battles for gambling purposes. One species at least inhabits the south of Europe, and indeed the name francolin is nothing else than the Italian *Francolino*, which means “free,” and as applied to birds, it really means such as are not free, at least to all the people, but such as are prized as game, and protected accordingly.

It is not, however, in the differences of structure to which we have alluded that the chief distinctions between the partridges and the francolins consist. The partridges are birds of the open champaigns, reposing at night on the ground. The francolins prefer the shade of woods, and perch for the night in trees. They also feed more upon animal matters, such as mollusca and worms, and they resort more to marshy places, and find part at least of their food by searching the mud of these with their bills. The difference in their structure accords with their habits. The enlarged tail enables them to rise with more facility than the partridges; and the more powerful bill enables them to poke in the mud and mire. Their voices are also much louder and harsher than those of the partridges; and they utter loud calls in the morning when they leave their perches, and in the evening when they return to them. But though they perch on trees for the night, the females nestle upon the ground, and rear their young very much after the manner of partridges, at least until they are so far fledged as to be able to fly to a perch.

Collared Francolin (*P. Francolinus*). This is the species which is found in the south of Europe. The upper part is black, rayed with white; the top of the head and the nape black, with yellow edges to the feathers; there is a white band under the eyes; the forehead, the space over the eyes, the throat, and all the under parts are deep black; but there is a broad distinct collar of maroon brown round the neck. The coverts of the wings are brown, with rays and spots of red, and the quills are black. The under tail-coverts are red; and there are large white spots on the flanks. The bill is black, the legs are reddish, and the spurs brown. The length of the full grown male bird is about twelve or thirteen inches. The female is rather smaller, of a yellowish fawn in the ground colour, streaked with red, grey, and brown on

on the upper part, and with brown on the neck and all the under part of the body.

Pondicherry Francolin. This species is also called the Pondicherry partridge; and indeed all the francolins and also the colins are partridges in common speech. As its name imports, this species is found in India, but it is of course not confined to the neighbourhood of Pondicherry. It came first from that place to France, and is one instance of the absurdity of calling animals after confined localities.

The upper parts are red, with zigzag bands of white; the top of the head reddish ash; the back of the neck grey, and streaked with black; the primary quills are pale ash, the secondaries red, with white round eyes; the rump is grey, mottled with black and white; the tail-feathers are brilliant red, bordered with black, except the two middle ones, which are russet, finely pencilled with brown, and crossed by four bands of yellow; the chin and upper part of the throat are yellow, with minute black spots; the breast pale rose-colour, waved with black; the belly white, with crescent-shaped black spots; the flanks are reddish with white spots; the bill is blackish, and the feet red. The length of the male is about ten inches. The female is pale fawn-colour, streaked with black on the upper part; the quills have black tips, and the coverts of the wings have nine or ten bands of white, with black at the ends; the head, the neck, and the upper part of the breast are brownish white, spotted with black; the lower part of the breast is white, and the belly brown with black lines.

Pearled Francolin. This is another eastern species, being found both in India and China. Upper part deep golden red; top of the head black with red margins to the feathers; front yellow; and sides of the head white, with a black spot on each: the quills black rayed with white; the coverts bright red, barred with black; the back of the neck and the breast black, and spotted with white, from which the name "pearled" is derived; the abdomen black, with small points of reddish; the bill black, and the feet red. Length eleven inches: the female is smaller. She has a black streak behind the eye; the feathers of the upper part margined with bright brown, and irregularly spotted with white.

There are many other species or varieties described in the catalogues, but those to which we have alluded must suffice as a specimen: nor should we, even if we were to detail the whole with the greatest minuteness, be thereby adding materially, or almost in any degree, to the quantity of useful knowledge; we should be merely mentioning a few more varieties of colour, and slight differences of size; for the habits of the birds are so nearly alike, that when we have mentioned in what they differ from the true partridges, we have told almost the whole tale of their natural history.

THE COLINS, or partridges of North America, differ in many of their habits, both from the partridges and the francolins of the eastern continent, or rather they combine many of the habits of both. They inhabit indiscriminately the open places and the woods, and sometimes parks, and at other times seek a sequestered repose upon the ground. The nest is, accordingly, sometimes in a bush, and sometimes in a tuft in the open prairie; but it is always formed of the same materials, and put together in the same rude manner. It is composed of a few sticks, lined with withered stalks and grass. They are very prolific, the eggs in a

single hatch being rarely fewer than fifteen, and often as many as five and twenty. When one brood have broken the shell, the male, at least in some of the species, takes the rearing of them, while the female proceeds with another hatch. All the hatches of the season are united into one flock, but as the birds are sought after with much avidity, both by the settlers and by the aboriginal inhabitants of the forests, and as they have besides many enemies, their numbers are very much thinned every season, before the time of reproduction again comes round.

These birds, many of which are recent additions to natural history, and of most of which the history is very imperfect, have been indiscriminately called partridges and quails. They have many points of resemblance to both; but in strict propriety they belong to neither; and thus they have been formed into a separate genus, under the name *Ortyx*. Some species have been mentioned as inhabiting South America, at least as far to the southward as Guiana, and the valley of the river Amazon; but there seems to be some little doubt on the subject. It may, however, be true that they pass gradually from the more typical ones of the north to the timanous of the south; but we are not yet in possession of any connected chain of data that will bear out such a conclusion. This consideration, as well as that of space, which the interest of this order of birds has already tempted us to exceed, force us to confine ourselves to the mere naming of one or two of the species.

THE VIRGINIAN QUAIL, OR PARTRIDGE (*Ortyx Virginianus*), inhabits the temperate parts of North America, and generally perches on trees. According to the accounts, this species appears to have at least one of the habits of the partridge, that is, it follows, rather than it crosses, the progress of cultivation and improvement. In this respect it is very different from most of the animals of the wild forests of America. These have, in general, fled before the march of the axe and the plough; and no more vestige of them remains in the places which are settled than if they had never been there. But the quail (as it is termed) is said to have come to settled places in which it was quite unknown while they remained in a state of nature. This is the case with the partridge, but with the partridge only among our analogous birds. The common quail has disappeared from England, and occurs only as a visitant, or if as a resident, is very rare. The grouse is also now unknown in many places where it was once abundant; but the partridge is more abundant than ever; and as the heath plants give way before the sheep farming, and the harsh tuft sward yields to the plough, the heath birds depart, and the partridge occupies their place. Such is reported to be the case even with Canada; and the birds have come in from the west, and not yet made their appearance in the valley of the St. Lawrence, below the fall of Niagara; but they have been described as resting in the fields of Upper Canada after dark, and uttering cries similar to those of partridges when they jug.

The Virginian quail, which must be widely extended, as it has also been called the northern quail, the Maryland quail, and the Mexican quail, has the upper part yellowish red, with ash-coloured and black borders to the feathers, and large black spots with red borders down the back. The scapulars and coverts are variously marked with ash-colour, brown and black. The smaller coverts are russet with

black lines. The quills black; the tail-coverts bluish ash; the front black; a double white line over the eye; the throat white with some black streaks; spots of white, russet and black on the head and neck; the breast reddish white, with cross streaks of black; the belly white with several spots of black; and the flanks red with small oval white spots, surrounded with rings of black. The bill black at the tip and reddish at the base, and the feet brown. It is a small species, the length being only between eight and nine inches. This species has been brought alive to Britain, has bred readily, and is domesticated in some parts of England, in Suffolk we believe, or at all events it is understood as being permanently established there.

Californian Quail (Ortyx Californica). This species, as the trivial name imports, is from the west coast of North America; but it is also found in Mexico, and appears to have been described under different names. The colours are various shades of brown, slate blue, and ash grey, picked out with red, black and white, and finely mixed and contrasted. The male has a black crest on the top of the head, part of the feathers of which curl forward. The female is without the crest, and has all the colours less bright.

Many other species or varieties have been named, and it is probable that many more may yet be discovered in a country so wide and wild, and so well adapted to the habits of such birds, as North America. But so little is known respecting them, and they appear to differ so little in manners, that they cannot be made interesting in a popular point of view.

QUAILS (*Coturnix*). The quails are smaller in size than the partridges, have the bill slender, no red membrane over the eye, and no spurs on the tarsi. In other respects, they bear a considerable resemblance to the partridges. The true quails are all natives of the eastern continents, and they are not found in the very cold latitudes. Although a more minute race than the partridges, the quails are more active birds, more discursive and prone to migration. They seem to admit of two divisions, the quails, properly so called, which have hind toes more or less produced; and those which have no hind toe, and which, for that reason, Temminck called *Hemipodius*, or half-footed. There is one structural character in the quails which is worthy of being borne in mind, as it explains, in part, why they are much more discursive in their habits than the partridges, and others of the family, or indeed than most of the gallinidæ. They have the first quill of the wings as long as the others, and thus their wings being less rounded are better adapted for long flight.

Common Quail (Coturnix major) has the upper part mottled with brown and grey, with a whitish or reddish streak along the middle of each feather. The top of the head is mottled with black and red, and marked with three longitudinal stripes of brownish white, the two lateral ones passing nearly over the eyes. The throat is black; the breast russet; the belly and thighs whitish; the bill black, and the feet flesh-colour. The length of the full grown male is between seven and a half and eight inches. The female has the breast white, spotted with black. Quails are subject to considerable varieties of colour, some being found much darker than the average, and others nearly all over yellowish white. The young of the year resemble the female, after which they vary

considerably in colour. Food and confinement have a good deal of effect upon their colours; for when they are kept under restraint and fed upon hempseed all their colours merge in one uniform brown. They are much longer winged in proportion to their size than most of the gallinidæ, the extent of the wings being about double the length of the body, while in the others it rarely exceeds one and a half. The common quail is found pretty generally throughout continental Europe, ranging nearly as far to the north as Lapland. It is also found in Asia, and is abundant in the south of Siberia, but is not met with in that country so far north as the shores of the Arctic Sea, or even in such high latitudes as it occurs in some parts of Europe. In China, and the countries farther to the southward, the common quail is very abundant, and there are also other species. They extend unto the eastern islands, and are very abundant in some parts of Africa. Though quails are more accustomed to running than flying, and although, for the most part, they are incapable of remaining for any length of time on the wing, without experiencing lassitude and fatigue, it is nevertheless certain that they undertake pretty extensive migrations, and in immense flocks, passing from the colder to the warmer latitudes in autumn, and retracing their way in spring; and there is reason to believe that their passage, notwithstanding the opinion of Colonel Montague, usually takes place in the course of the night, for they are accustomed to sleep, or at least to repose, during the greater part of the day, hiding themselves in the tallest grass, where they are sometimes run in upon by dogs before they are flushed. They are met with in many parts of this island, but seldom in any considerable numbers. They leave us in August or September, are supposed to winter in Africa, and return early in the spring. On their arrival at Alexandria, such multitudes of them are exposed for sale, that the crews of merchants vessels are fed on them, and complaints have been laid at the consul's office by mariners against their captains, for giving them nothing but quails to eat. They have been known, when having wind and weather in their favour, to perform a flight of fifty leagues across the Black Sea in the course of a night. On the western coast of the kingdom of Naples, in the vicinity of Nettuno, sometimes quails have appeared in such prodigious quantities, that a hundred thousand have been caught in one day, and within the limited space of three or four miles. The principal part of them were conveyed to Rome, where they are in great request, and fetch a very high price. Along the shores of Bovenia, especially on the lands belonging to the bishop of Frejus that border on the sea, they alight in such vast numbers in the spring, that for the first two or three days they are occasionally found so exhausted as to be caught with the hand. In some parts of the south of Russia they so much abound, that during the periods of their migration they are taken by thousands, and are sent in casks to Petersburg and Moscow. The English import not a few from France for the table, all of them males. They fight fiercely for the females, whom they abandon when incubation commences. The hen bird scrapes a hole in the ground, generally in a corn field, and consigns to it from eight to twenty eggs, of a bright green colour, dotted with minute blotches of brown or black. The incubation lasts three weeks; and the young, which are produced covered with down,

run on coming out of the shell, and are much sooner able to provide for themselves than the young partridges are. To such of them as happen to be produced on a strong argillaceous soil, drought is very unfavourable and they are very apt to die in consequence of getting entangled in the fissures. The mother continues by them till the autumnal migration, at which period solitary quails are seldom met with; but, though living in small flocks of four or five, when started they disperse in different directions, and quickly reassemble near the spot from which they were roused. The young utter a feeble and plaintive cry when they wish to flock together. That of the adults is more harsh and grating, and the males are readily decoyed by the quail-pipe, with which the fowler imitates the call of the female. From the pugnacious dispositions of the males, they were exhibited by the Athenians and Romans, in regular combats; and in China, Sumatra, and some districts of Italy, the practice of quail fighting is still cherished. As quails are reckoned very delicate eating, and are capable of receiving a considerable quantity of fat, they are killed in great numbers for the table; but they will not breed in a domesticated state.

Chinese Quail. This species is of course abundant in the country after which it is named; but it is not confined to that country, but ranges pretty extensively over the Philippines, and the other islands to the eastward of China. It is a very small species, not above four inches and a half in length; but it is a pretty little bird, easily tamed, and the Chinese are reported to make use of it for the purpose of warming their hands, and likewise rear it for fighting. The colours are: upper parts of the body brown, sprinkled with black spots, and white lines, throat black, arches on the neck white, the middle of the belly chestnut.

New Holland Quail. About seven inches in length. Upper part clouded chestnut streaked with black, and with white shafts to the feathers, under part reddish ash, with black crescent spots placed cross-wise.

There are numerous other species or varieties described by authors or preserved in museums; but it does not appear that they have any marked characters in which they differ much from the common species.

HEMIPODIUS. As already mentioned, these birds differ structurally from the quails in being entirely without hind toes. They are in general inhabitants of dry and sandy places, in running upon which the hind toe would be an incumbrance to them rather than any thing else; and hence we find that in all birds which inhabit sandy places the hind toe is either wanting, or merely rudimental. These birds are little known, because they have no European type, and also because they frequent those parts of foreign countries which Europeans visit the least. They appear to be altogether confined to the southern and eastern world, and to have a locality in that direction more remote from Europe than any other of the gallinidæ. Among them may be mentioned the fighting quail of Java, which the inhabitants of that country engage in gambling battles, as was done with game cocks in barbarous times and places of the western world. We must not, however, wonder at the Javanese for being so deeply interested in the issue of a battle between those comparatively small

birds; because, among the natives of that country, nothing is more common than for a man to stake first all his property, and then the freedom of his wife and children, upon the issue of a duel between two black beetles, whose battle takes place in a little chip box.

The Heteroclyte (Syrrhaptes) may be considered as forming the last of this division of the order; and, indeed, it is not very easy to find out its proper place in the system, as it is not, strictly speaking, either a quail or a grouse, though, according to the description, it partakes of the characters of both. There is but one species, which inhabits the extensive sandy plains of central Asia, to the southward of the lake of Baikal; and for the knowledge of it naturalists are indebted to Professor Pallas. And as for its habits we know very little of them, excepting that it lives in very bare and desolate pastures, and must, from its structure, depend much more on its wings than on its feet in searching for its food; and this peculiarity takes it not only out of the properly established groups of partridges, grouse, and quails, but out of the order of *Gallinidæ* altogether, with which, however, they may use the wing in perching, in migrating, or for other purposes; without almost one exception they make use of the foot in searching for their food. The feet of this bird are peculiar: the tarsi are very short, and so are the toes, and they are completely feathered, so as to have the appearance more of a defence against extreme heat or extreme cold than any thing else. The wings are much longer than in most of the order; and they are differently formed, being adapted for long flight and ready turning when in the air, as the first quill is the longest. The two middle feathers of the tail are also considerably produced.

The generic characters are: the bill short, slender, and conical; the upper mandible slightly arched, with a channel on each side of the culmen, and the nostrils basal and lateral, and covered with the feathers of the front. The feet with only three toes, all to the front, united by membrane almost as far as the claws; the tail-feathers increase in length in regular stages from the sides, except the two middle ones, which are elongated and very narrow.

Pallas' heteroclyte (Heteroclitus turtaceus of Vieillot) is the only known species. It is yellowish ash on the upper part, with black margins to the feathers, and a number of crescent spots of black along the back. The top of the head is marked by a line of similar spots; the sides of the neck are orange yellow, of which the tint is brighter on the throat. The coverts of the wings have purple red on the tips; and the quills are black, with orange yellow on the margins of the webs. The tail-feathers are yellowish ash, with white tips, except the two produced ones, which are black. The belly is yellowish ash, and the rest of the under part whitish, the former bordered with a large band of black. The bill is yellowish, and the claws black. The length of the male bird is about a foot. The female differs little in size or in markings, but is very easily distinguished from the other sex by wanting the produced tail-feathers which form so peculiar a character in the male.

The Tartars call this bird *Tsadtscha*; and describe it as being rare, or, at all events, rarely seen. They are wild, and the people can kill them only with their arrows; and as they inhabit the wild and bare places, where there is no pasturage, and little other

inducement of any kind for the people to resort to them, the birds are but very little known, even in their native locality. Their food is, accordingly, but little known; but it is supposed to consist, in part at least, of small insects, which are among the chief productions of the wilds. Those who have observed them with the greatest care, represent them as walking very slowly, and with apparent difficulty, so that they are obliged now and then to squat down for the purpose of resting themselves. On the wing they are a good deal more active, flying rapidly, and at a considerable elevation; but they do not continue long on the wing at a time. Their habitation is among the bare and shifting sand of the deserts; and, in addition to insect food, they scrape the sand for those small seeds which are drifted into it by the winds; and which, from the perfectly sterile nature of the soil into which they are brought, would be lost, were it not for these birds. Delanane mentions that, in his passage across these wilds, toward the Chinese frontier, he often came upon the females in the act of incubation; and that he found them such close and pertinacious sitters, which would not quit their eggs till the very last extremity. The nest he mentions as very rude, consisting of a small hollow in the sand, lined with a few such withered leaves of hard grass as can be picked up in the places which the birds inhabit. The eggs are represented as being uniformly four in number, which is different from that of any species of *Gallinidæ*, which is well made, and forms another reason for doubting whether these birds have been referred to their proper place in the system.

Such is nearly the sum of all the information that we possess respecting one of the most singular of birds, both in its structure, and in the regions which it inhabits. How it may summer and winter in those dismal wastes, it is not easy even to conjecture; but it shows that the sterility of a region must be extreme indeed if it cannot furnish support to some living inhabitant. This bird appears to be at home amid bare stones and loose sand, and in such places only; for, according to the accounts, it never resorts to the more fertile places. Nor is it at all impossible that, even where it inhabits, the end of autumn and the beginning of winter may be the season of plenty, as well as it is in those places where there is a crop and harvest of vegetation upon the ground. The seasonal winds sweep over those regions with great violence, as is testified by the storms which rage upon the lake Baikal, where the winds of the desert and of the inland country may be said to meet; and they must, while the heat of the sand continues, bring with them a number of seeds, and along with these, or rather in them, a number of the eggs of those insects, the appearance of which, in such deserts, could not otherwise be very easily accounted for. But we must proceed with our notice of the remaining group or family of the *Gallinidæ*.

GROUSE. Grouse admit of division into two sections; the grouse properly so called, which are inhabitants of woods, heaths, and other places which are wild, but not destitute of vegetation; and wild grouse, which, as the name implies, are found chiefly in the arid wastes. The former have what may be considered as a polar habitat; or, in more temperate climates, they are found only in elevated and comparatively cold places. The latter are found farther

to the south, as there are no arid or sandy places in countries which have polar latitudes. The reason of this is very evident; but still it is worth mentioning, as helping to carry us on towards a proper understanding of the adaptation of animals to their haunts.

The grouse, properly so called, notwithstanding their differences of appearance, form altogether a very natural and well defined family. They are conveniently divided into three sub-genera, or sections:—*Tetrao*, in which the toes are bare of feathers; *Bonascus*, in which the toes and tarsi are feathered on the upper sides; and *Lagopus*, in which they are feathered down to, and also under and between, the toes. All of them have the tarsi feathered, which forms a distinction between grouse and partridges. The first inhabit most southerly and lowest down, bordering on the pastures of the partridges; the last are the most northerly and the most lofty inhabitants; and the second, or those with half the tarsi feathered, are intermediate between the other two. They are all birds of the north of the one continent or the other, or they are common to both; which latter appears to be the case only with the feathery-footed race which inhabit the extreme north. All the grouse are highly interesting birds, as they inhabit the wild places only, and do no harm to man; and they breed very rapidly, and all furnish choice dishes for the table, but our limits will not admit of more than a few brief notices. In doing this we shall take the bird of the eastern continent, and the one of the western, which appears to agree most nearly with it in immediate succession.

TETRAO or grouse, with the tarsi bare of feathers.

Black cock (T. tetrix.) This species belongs to the eastern continent, where it inhabits the low and sheltered moors, and the borders of streams and marshes. It is a bird of considerable size. The male is about two feet in length, and three feet in the stretch of the wings; and when in prime condition, which is in the early part of winter, the weight is from three to four pounds. The upper parts of the body are black, glossed with rich reflections of purple, blue, and bronze green. The blue is finest on the neck, and the green on the feathers of the tail, purple being the prevailing lustre on the back. The under part is deep and dead black, with the exception of the under tail-coverts, which are white. A spot on the reverse of the wing, the tip of the bastard wing, the bases of the quills, except the first four, and the tips of the secondary quills are also white. The wings are broad; and the tail consists of sixteen feathers, the external ones a little produced, and curling outwards, so as to form a peculiar fork. The naked space over the eye is of a very bright scarlet colour, and granulated. The female is about one-third less in the lineal dimensions than the male; the tail is not so much produced, and the forking is barely perceptible. The general colour is brown, deeper on the back than any other part, and mottled all over with black.

They frequent the sequestered places where there are brushwoods and copses; and perch during the night, though they feed upon the ground. In autumn they eat wild berries and seeds, in winter the buds of trees, and it is probable that during the time when the buds are over, and the seeds and berries not ripe, they feed, in part at least, upon insects and worms.

In autumn and winter the males live in flocks and

at peace ; but when the warm season sets in, and they put on the rich glosses of their nuptial plumage, they fight lustily for the females, as is the case with all polygamous birds. At this period, which is earlier or later in the year, according to the season and the place, but seldom before March or after April, in the British Islands, they are astir by the streak of dawn, crowing, uttering a harsh grating sound, like that of the sharpening of a knife, and otherwise making as much noise in the cold as they can. The eggs are about eight in number, and less than that in the case of a second brood. The nest is rude and on the ground, and the female does not perch until her brood are able to perch along with her. During this time the male remains in the close vicinity of the females, watching them and their broods with great attention ; and, when the broods are matured, he joins the other males for the season of celibacy. If the male is killed early in the season, the females join the neighbouring harems ; but they remain true to the same male for the season if he remains alive. The external distinctions of sex do not appear in the young till the season is far advanced.

The black cock, or black game, are found in many parts of the British Islands ; but more abundantly in some parts of Scotland than in England. They are also not uncommon on the continent, but there also they prefer the more northerly countries, though not the extreme of the latitude.

In Sweden and the other cold countries of the north, where the snows fall heavy and lie long, the black cock betake themselves to snow-houses, as is the case with the other ground birds, and with many of the human race, as, for instance, the Esquimaux, in the extreme north of America. They form burrows, with a breathing aperture, or often with two, in order that they may escape from the predatory mammalia. During their retreat in these places, they eat very little, and do not require it, as the temperature is low and uniform, and they have no action that can occasion any waste. These birds are highly prized as game, though their flesh has not perhaps so much flavour as that of some of the others.

The Dusky Grouse (*T. obscurus*) is the American species, which appears to agree in most particulars with the black cock of the eastern continent. In size and colour it is very nearly the same as the European species ; but the tail of the male bird is very differently formed. It consists of twenty broad feathers, the tips of which individually are rounded, as is also the general outline of the tail. The colours of the female also resemble those of the females in Europe, only there are more white mottlings on the chin. The size of the female also bears nearly the same proportion to the male as in the European species.

The form of the tail in this species indicates a more constant habit of ascending and descending than that of the black-cock, a more woodland bird in short ; and this is confirmed by the locality and the habit in so far as observation has gone. The birds are found in the elevated places of the rocky mountains ; and the first known specimen was obtained in 1820, by Major Long, at an elevation of 2000 feet, above the level of the sea, and to the westward of the water-shed between the rivers of that place to the Pacific and the branches of the Mississippi. We are not aware that any specimen has been met with, either in the central valley or in the hills towards the Atlantic. The habits of the

bird are altogether unknown, further than can be inferred from its being a grouse, and inhabiting mountain thickets.

The Wood Grouse (*T. urogallus*) is a species peculiar to the eastern continent, and it is one of the most celebrated both for its size and its beauty. It was once an inhabitant of the forests in the north of Scotland ; but it is extinct there now ; though very common to the north of the Baltic, and also in most of the pine forests immediately to the south. In those places where it is abundant, several species are noticed, differing from each other in size, colour, shape of the head, and some other particulars ; but these are of too trivial a nature to be admitted into a hasty general sketch, in which we must confine ourselves to the average or prevailing character.

The neck and upper parts of the body are of a dusky colour, waved across with ash-colour ; the under part is also dusky, but rather paler in the tint, and marked with white spots ; and the under part of the union of the wings with the body is also white ; the breast is green with rich bronze reflections ; and the tail is black with two white spots near the tip of each feather. The length is about two feet nine, and the extent of the wings about three feet. The female is about half a foot shorter than the male, and proportionally less in all her dimensions. She is mottled all over the upper part with dull red, black and white ; the throat and breast brighter red. The young males resemble the female till the first moult, when they begin to show a little green on the throat.

This is truly a splendid bird, equal in size to the turkey, at least on the average, as reared in confinement. The common weight is about seven or eight pounds, but specimens have been found as heavy as fifteen pounds.

These birds are chiefly confined to what may be considered as the northern zone of the eastern continent, that is, not to the south of the Altaian mountains, on the east of Asia, or of the arid flats northward of the Caspian, in the west, while in Europe they are very rare to the south of the Carpathian ridge, and not abundant even on the northern slopes of these mountains. The great pine forests of the north are their favourite haunts ; and they disappear when those forests cease to exist.

Their principal food appears to consist of the berries of the juniper, the vacciniums, and other small fruit-bearing shrubs of the high latitudes, and also of the buds and young sprouts of pines, the buds and succulent leaves of various plants, and probably also worms and insects. These birds, like domestic poultry, swallow small pebbles, and scratch the soil with their feet. They resort to the copses for food in the morning and evening, and during the day they retire into the thickest recesses of the woods. About the beginning of April their breeding season commences, when they perch with little interruption, and when the male may be seen, at sunrise and in the evening, much agitated on one of the largest branches of the pines, with his tail expanded and raised, and his wings drooping, sometimes walking backwards and forwards, with his neck stretched out, his head inflated, and his eyebrows of a deep crimson. His wooing call commences by a sort of explosion, instantly followed by a sound like the whetting of a scythe, which ceases and recommences alternately for about an hour, and is then terminated

by a similar explosive noise as at the beginning. He is apparently so deaf and insensible, during this singular exhibition, that, though at other times very wild and vigilant, the sportsman may gradually approach him, and take a fatal aim. This ardour of temperament continues till June. The female deposits in an artless situation in her nest on the ground, and among moss, from eight to sixteen eggs, which are about the size of those of the common hen, but more obtuse at the ends, and yellowish white, sprinkled with yellow spots irregularly. When she quits her nest in search of food, she covers the eggs over with leaves or moss. The young, immediately on their exclusion, follow her with great agility, and she leads them to procure wild berries, and the pupæ of ants. The brood follow the mother for nearly two months, at the expiration of which period the young males entirely forsake her, living till the beginning of spring harmoniously together, when they separate and affect solitude, never approaching but in the spirit of hostility, every male being jealous of an intruder, and resisting him with determined obstinacy. In the provinces of Smaland and Gothland, in Sweden, a hybrid but barren offspring is produced between the present species and the black grouse. The flesh of the former, though very dark coloured, is much relished by epicures, when it has not contracted too much of a bitter flavour, by copiously feeding on juniper-berries; and it is often conveyed in winter, in a perfectly eatable state, from Norway to this island. The eggs are accounted preferable to those of every other bird, and are very much in request. But all attempts, it appears, have failed to habituate the species to confinement in a poultry yard.

The Cock of the Plains (T. urophasianus). This species is mentioned, by the writers on American ornithology, as approaching most nearly to the wood grouse of the eastern continent. That it does so in size is true; but both its appearance and its habits are different. It is not, strictly speaking, a woodland bird, but rather an inhabitant of the margins of the woods; and we believe the older hunters in North America used to give it the name, "The Prairie Turkey." The tail is very different from that of the European, which is narrow and tapering, and does not indicate so frequent a habit of ascending and descending as the broad-tailed bird of the east. This, like the other American species formerly mentioned, is understood to range to both sides of the Rocky Mountains; and as far at least as California to the south. It is mentioned as being but very indifferent as an article for the table, although it is of such large size. Its food appears to be the leaves and buds of various plants, which are found in the wild places where the bird itself has been met with.

The male, when full grown, measures thirty inches in length; the female is considerably less. The general colour of the plumage of both birds is brownish black; but the female has the fore neck and breast streaked with greyish white; and the feathers of the neck in the male, but not in the female, are produced, something like those of the hackle of the common domestic cock. The pairing time of these birds is in the spring; and the late Mr. Douglas, who is an excellent authority in such matters, says that "small eminences on the banks of streams are the places usually selected for celebrating the weddings; the time generally about sunrise. The wings

of the male are lowered, and buzzing on the ground; the tail spread like a fan, somewhat erect; the bare yellow œsophagus inflated to a prodigious size, fully half as large as his body; and from its soft membranous substance being well contrasted with the scale-like feathers below it on the breast, and the flexile silky feathers on the neck, which, on these occasions, stand erect. In this grotesque form he displays, in the presence of his intended mate, a variety of pleasing attitudes. His love-song is a confused, grating, but not offensively disagreeable tone—something that we can imitate, but have a difficulty in expressing, ending in a deep hollow tone, not unlike the sound produced by blowing into a large reed." These birds build in the plains, on a tuft on the ground, or near water. The nest is carelessly put together, and is constructed of twigs and dry grass. The colour of the eggs is wood-brown, blotched irregularly with chocolate brown at the larger end; they equal in size those of the common hen, and in number they vary from thirteen to seventeen. The time of incubation is about twenty-one days; and shortly after the young are hatched they quit the nest.

These birds appear to belong chiefly, if not exclusively, to the west side of America; and the places of their habitation are those naked plains where there is no vegetation exceeding a bush of very humble growth. It is impossible, therefore, that they can be perching birds, as the wood grouse of Europe is, simply because they have nothing on which to perch. Their wings are feeble and of small dimensions in proportion to the size and weight of their bodies; and their progress through the air is, consequently, effected rather by a fluttering motion, than by a direct and continuous flight. They rise flutteringly at first, giving a few hurried strokes with their wings; and after flying for a short distance, with a wriggling course, and making much whirring sound with their wings, they again alight.

During the summer, and greater part of autumn, these birds continue in families; but when the cold weather begins to set in, the families form into packs, which sometimes amount to several hundreds. Seeds and small fruits are their food at this season, and they get fat; but, as already noticed, the quality of their flesh is very inferior.

Richardson's Grouse (T. Richardsonii). This is another American species of the Rocky Mountains, and, like the preceding species, understood to be most abundant to the westward of the summits. It is a much more upland and woodland bird than the last, more graceful on the wing, more active in its motions, and far more valuable as an article of food. The sides of the head and throat black, with pure white spots; feathers on the breast black, with pure white spots; white spots also on the flanks, and the under tail-coverts white; tail, sixteen feathers, rather long, rounded. Female smaller, less black, but more rusty; general colours duller. Nest in bushes, eggs not so numerous as in many of the other species. The male is dull lead-colour and brown, variously blended and contrasted. The female is yellowish brown and black, with some white streaks. The weight is between two pounds and a half and three pounds.

April is the pairing time; and the nests are placed on the copses on the hills, but not high upon the mountains. The eggs are from a dozen to twenty, as

large as those of a hen, and with red spots on both ends. The female sits about three weeks. They eat buds and berries; their voices are soft and murmuring; their flight straight forward, steady, and graceful. They perch in the thick pine trees, and when they are to take wing from a perch, they get an impetus by dropping down, and then dash onwards.

Sharp-tailed Grouse (*T. phasianellus*) is remarkable for the narrow and pointed form of the tail. It is rather a northerly species on the American continent, being met with in the wild country to the westward of Hudson's Bay, but it also occurs in the Rocky Mountains.

The male is sixteen inches long and twenty-three in extent of wings. The ground colour is blackish with markings of rust colour and white. The female is rather smaller than the male, and mottled with black and rusty yellow. The nest is rude, and placed in the cover of some bush. The female lays from nine to thirteen eggs, which are white with blackish spots. The young are hatched about the middle of June; they utter a piping noise resembling that of chickens. From want of suitable food or some other cause, it is found impossible to rear them in a domestic state, however carefully they are attended to. These birds are very plump when in good condition, and weigh upwards of two pounds.

Franklin's Grouse (*T. Franklini*). This is the spotted grouse of the Rocky Mountains, and bears some resemblance to its Canadian congener. General plumage, alternate bars of black and greyish brown, very bright and glossy; head, neck, and breast nearly black, and tail entirely so, but with white spots on the upper and under coverts, and spots of the same colour on the flanks. Nest on the ground in concealment; eggs five to seven, the size of those of the wood-pigeon, and dull white. The cry harsh, resembling that of the Guinea fowl. Rather a mountaineer, and found in the north and west parts of America.

Canada spotted Grouse (*T. Canadensis*) inhabits Canada, the northern parts of the United States, and the north of America generally. It is a woodland species, resembling the wood grouse of Europe in some of its habits. Has a strong flavour of spruce in winter, but is better in the summer months. Nests on the ground, but perches in trees, and takes to them for safety when alarmed. Length fifteen inches; general colour of the male black and grey.

Red Grouse (*T. Scoticus*). General colour chestnut brown; eyebrow notched, very elevated; earuncle on the brow crescent-shaped and scarlet. Sixteen feathers in the tail, the external ones black at the bases. Colours of the female less bright, with zig-zag black lines, and little or no red in the eyebrow. Young, bright russet with black stripes and spots. Length of the male sixteen inches; weight nearly a pound and a quarter.

Inhabits open heaths and not woods, remaining on the ground, and never perching. It occurs on the mountains of Wales and the north of England, but more plentifully in the highlands of Scotland, and in the waste of North Britain in general. They are likewise met with in the Hebrides, the islands of the Clyde, and in the bogs and mountains of Ireland; but those noticed by Buffon as natives of France, Italy, Spain, &c., seem either to form distinct species or at least varieties. Linnæus appears to have been

unacquainted with them, and Gmelin regarded them as a variety of the ptarmigan. In this country they feed on the mountain and bog berries, and, should there be none of these, on the tops of the heath. The number of eggs which the female lays is from eight to fourteen, and not unlike those of the black grouse, but smaller, in a rude nest on the ground. The young brood continue with the hen till the winter, when they unite in flocks, sometimes to the amount of thirty or forty, and are then, from their shyness, very difficult to be shot. They sometimes descend, when the winter is very severe, from the hilly tracts, in prodigious numbers. The shooting of them is a very favourite diversion in autumn by our gentry, on the Scottish moors, and their flesh is esteemed a dainty, but very soon becomes tainted, especially if the birds are not drawn immediately on being killed. Several instances are recorded of their being reared in a domesticated state. Besides the beauty of this species, the abundance of its numbers, the interesting character of the places in which it is found, and the facilities of access to them from all parts of the British islands, it possesses the recommendation of being truly a British species.

BONASIA. With the upper sides of the toes feathered, but not the under.

Hazel Grouse. Feathers on the head somewhat long; but the species is much disposed to break into accidental varieties. Upper part brown, with red, black, and white spots. Length about fourteen inches, wings twenty-one in extent. It is a mountain species, and found pretty generally in the elevated woods throughout Europe, from the Carpathian Mountains to the Strait of Gibraltar, but not in the extreme north. It roosts in thick trees; feeds on heath tops, berries, and buds. The nest is placed on the ground under a tree, or thick tuft of heath. The eggs vary from twelve to eighteen, are rather larger than those of a pigeon, yellowish white with irregular brown spots. The incubation lasts three weeks; the young run about as soon as they break the shell; and the mother calls them to her with a clucking sound. The flesh is dark outside, and whitish internally: it is much prized, and is reported to be the only viand upon which a German prince will consent to feast twice in succession.

Ruffed Grouse (*B. umbellus*). The head furnished with a crest; the upper part varied with brown, red, and black; the under rusty white, with brown moon spots on the breast; feathers on the scapulars enlarged, and deep azure; tufts on each side of the neck of a bright black, glossed with steel blue, and capable of being much distended. The crest and ruff are barely visible in the female. Very common in the eastern parts of America. The female breeds twice in the year; the nest among dry leaves under a tree; eggs from nine to sixteen; incubation three weeks; general food grains and fruits. In the breeding season the male makes a flapping noise with his wings, which has been compared to the beating of the drum, and also to distant thunder; but it often costs the bird his life, by betraying him to the hunter.

There are some more species or varieties in this section, but what have been mentioned must suffice as a specimen.

LAGOPUS. Tarsi and toes completely feathered, so as to fit the bird for enduring the greatest severity of cold in its feet.

Ptarmigans (*L. variabilis*). Ash-coloured and white in summer, almost entirely white in winter, except the tips and shafts of the primary feathers which are black, with white tips; a black spot between the beak and eyes of the male; eighteen feathers in the tail; feet covered with feathers. Ptarmigans haunt the lofty heights of mountainous countries in Europe, Asia, and America, as the Alps and Pyrennees, the Highlands of Scotland, Siberia, Greenland, Hudson's Bay, Canada, &c., descending within the range of vegetation to feed on the buds of trees, the young shoots of pines and heath, mountain berries, rhododendron, insects, &c., but returning, when satiated, and even in winter, to their almost inaccessible retreats, which are generally screened alike from the sun and the wind, and are often formed of holes in the snow. They live quietly during winter, in family parties of from six to ten individuals; but they separate and pair in June, resorting to a lower residence on the hill, and breeding apart. Each pair scratch a circular hole, of about eight inches in diameter, at the foot of a rock or bush; and the female, with hardly any other preparation, lays from six to twelve eggs, larger than those of the partridge, of a reddish-grey hue, and spotted with black. In three weeks these are hatched, and the young come forth covered with down, which is brown, black, and yellowish, on the head and upper parts of the body, and of a whitish yellow on the under. The mother defends her young with great courage and intrepidity, and hesitates not to fly on those who seek to carry them off. Contrary to what has been observed of most other gallinaceous birds, the male is assiduously attentive to his mate when breeding, roaming about the nest, frequently uttering his cry, and carefully fetching her food, without, however, taking her place on the eggs. As soon as the young are produced, the parents conduct them to a more elevated station, where their growth proceeds rapidly. A great number of them fall a sacrifice to eagles and hawks. The ptarmigans skulk under bushes or projections of the rocks at sight of these formidable invaders; but they seem not to dread the approach of man, until they have experienced his hostile power, after which they endeavour to elude his attacks. Picot de Perouse says he has watched their manners in the Pyrennees, and that they are by no means so stupid as described by Gesner, but court independence and shun danger with the sagacity that is common to animals. In some of the Highland districts their gay summer attire assimilates them to their native rocks, and their winter livery to the snow by which they are surrounded, so that they are less readily discriminated by the sportsman. They fly heavily, but run swiftly. The cry of the male, which may often be heard in the night, somewhat resembles the croaking of a frog, and that of the female that of a young fowl. In this island they occur on the summits of the Grampian ridge, and also, though rarely, on the loftiest hills of Cumberland and Wales. These birds, being naturally very shy, cannot be domesticated without very great care and attention; but rare instances are known of their breeding in confinement. The young bird, in flavour, is not inferior to that of the black cock, and the fowler has been known, even at the risk of his life, to hunt them.

Willow Grouse (*L. saliceti*). This species is found in the north of the two continents, but on different grounds from the mountain ptarmigan. We give the

following account of it from Dr. Richardson:—"The willow grouse inhabits the fur countries, from the fiftieth to the seventieth parallels of latitude, within which limits it is partially migratory; breeding in the valleys of the Rocky Mountains, the barren grounds, and arctic coasts; collecting in flocks on the approach of winter, and retiring southward as the severity of the weather increases; considerable bodies, however, remaining in the woody tracts as far north as latitude 67°, even in the coldest winters. It is tolerably abundant in the sixty-fifth parallel all the year, and assembles in vast flocks on the shores of Hudson's Bay in the winter time." The species seems to be identical with the willow-grouse of the old continent, which inhabits the greater part of Scandinavia, Kamtschatka, Greenland, and Zealand, and also the valleys of the Alps. In America these grouse shelter themselves in the winter in thickets of willow and dwarf birches, on the banks of marshes and lakes, the tops and buds of the shrubs constituting the principal part of their food at that season. Denuded sandy spots are favourite resorts in the day time; but they pass the night in holes in the snow. When pursued by a sportsman or bird of prey, they often terminate their flight by diving precipitately into the loose snow, endeavouring to escape by working their way beneath the surface, which they do with considerable celerity in thick, windy, or snowy weather; they are very shy, and they often perch on the taller willows, when it requires a sharp eye to distinguish them from flakes of snow. In the breeding season they feed mostly on the berries of the *Empetrum nigrum*, *Vaccinium vitis idæa*, and *Arbutus Alpina*, which are exposed by the first thaws, and do not disappear until replaced by the new crop. At the commencement of this period they begin to lose their snow-white winter dress, the male changing first, his head and neck becoming red, and, when viewed from a distance, contrasting so strongly with the white body as to appear as if they were stripped of their feathers, and quite raw. The beginning of June is the period of incubation, and the female then moults, the delay being admirably suited to her habits, and well calculated to ensure her safety. The male puts on his coloured plumage as soon as the rocks and eminences most exposed to the sun become bare, and at a time when he is accustomed to stand on a large stone, and call, in a loud croaking voice, to the females, that hide themselves in their white dress among the unmelted snow on the more level ground. Like most other birds that summer within the arctic circle, they are more in motion in the milder light of night than in the broad glare of day. The eggs are bright or dark yellow, with chestnut-brown spots or dots.

Rock Grouse (*Lagopus rupestris*) is another species found in both continents. It resembles the ptarmigan in many particulars, but is smaller in size, or more black and brown, and less ash colour in its common plumage. It is met with in the extreme north of America, Greenland, and in Scandinavia; and is, in fact, the most northerly of the *Gallinidæ*. It breeds late in the season.

PTEROCLES form the last genus of the *Gallinidæ*. They are peculiar to the warm latitudes of the eastern continent, and generally inhabit waste and sandy places. Their most general characters are: the wings long, and adapted for considerable flight; the tail pointed, and the feet naked; the tarsi stout, and the three front toes short—the hind one often want-

ing. The space round the eye is generally naked, but it wants the fine red colour which appears in the grouse. The more particular characters are: the bill of mean length, compressed, slender in most of the species; the upper mandible straight in the principal part of its length, and curved only near the tip. The nostrils basal, half closed above with a membrane, and covered with the feathers of the front. The three front toes united by membrane as far as the first joint. The hind toe often wanting, or a mere rudiment, and in all cases articulated so far up on the tarsus as not to touch the ground in walking. The claws, with the exception of that on the hind toe, are rather obtuse and broad. The tail is long and wedge-shaped or pointed, the two middle feathers being often produced beyond the others. The wings long and pointed, the first quill being the longest. As there is none of the genus resident or visitant in the British islands, they have no appropriate English names; for the compounds of the word "grouse," with other epithets which have been given to them, are not applicable. The French call them *gargas*.

P. Alchata, the "pin-tailed grouse" of Latham, is found in the south of Europe, but only in hot and sandy places. It is yellowish, rayed with black on the upper part, with the points of the scapular feathers bluish. The lesser coverts are streaked with red and brown, and have white tips. The head and neck are ash colour, and the throat black, with a large collar of pale orange, bordered with black. The under parts are whitish. The tail-feathers are white at the terminations, and the three middle ones slender and longer than the rest by three inches. The length is thirteen or fourteen inches. They are far more numerous in the dry places of the north of Africa and southwest of Asia than they are in the south of Europe. The young are eaten, but the old birds are of small value. We can afford space only to mention one or two of the others.

P. Tachypætes (*Namaqua*) is bright red, brown, and black on the upper part; purplish on the under, and about ten inches in length. It is found in the sultry deserts of Africa, where the flocks, which are numerous, often guide the traveller to the springs, pools, and water-courses; but if the birds clear the horizon, without wheeling or halting, it is a sign that there is no water near; and a very painful sign in such a country.

P. quadricinctus (the "Indian grouse" of some authors) is a native of India. The upper parts are yellowish, rayed with brown and black; the coverts of the wings yellow, with a broad band of white and one of black; the forehead white, crossed at the top with a black band; the back of the head russet, with black lines. The breast rays with white and black, forming four narrow cinctures; the under parts white, with black lines; the bill yellow, and the feet and claws brown. The length of the male is about nine inches and a half. The female is smaller and paler in the colours.

P. arenarius. (sand grouse of authors) inhabits the sandy places of western Asia and Africa, but is also found in some of the more arid spots of the south of Europe. Upper part yellowish ash, spotted with blue and yellow. The belly, thighs, under tail-coverts, and tail-feathers black; the breast reddish ash, with one black band across. Length twelve to fourteen inches. This is understood to be a migratory bird, for which the form of its wings is well adapted. Its range is

from the sandy steppes in the south of Russia, to the borders of the African desert on the Nile, and, probably, also on the Niger. The hind toe is wholly wanting in this species, but there is sometimes a rudiment of a claw or spur in, or, at least near, its place.

There are several more species or accidental varieties of these singular birds; but they differ from those that have been named in so few particulars, and the manners of them are so imperfectly known, that we shall not name any of the remaining ones. Thus we must close our very brief sketch of the *Gallinidæ*, an order of birds which, in as far as value to man is concerned, has no equal in the feathered race. It would have been pleasant to us to enter into many more details, but we trust that what has been said will be useful in itself, and lead to the desire and the attainment of further knowledge.

GALLINULE (*Gallinula*) — the "water hen." A genus of *Echassiers*, or stilt birds, belonging to the long-toed or macrodactylic division. The characters are: the bill shorter than the head, compressed, conical, and generally higher than broad at the base. The mandibles are of equal length, both compressed at the extremity, and the upper one curved at the tip. The nostrils are placed laterally in the bill, at about the middle of its length, and they are longitudinal and in part covered by membrane. The tarsi are long, and so are the toes, of which there are three to the front and one to the rear, the front ones bordered with a straight membrane. The wings are of mean length, and hollow; the first quill is shorter than the second, and the third and fourth are the longest in the wing.

It is not very easy to assign to these birds their proper place in the system. They have been united with other races by different authors, but they do not harmonise properly with any. They have been confounded with the rails, and also with the coots; but they differ from both in structure as well as in habits. Their habits are as perplexing as their generic characters. They are not, strictly speaking, land birds or water birds; and as little can they be included in any of the ordinary sections of those which are termed shore or beach birds; for these last are in general short-toed birds, fitted for running upon sand or gravel. These birds are more aquatic than the rails, but less so than the coots, for they do not launch themselves upon the water and remain at comparative rest there, though they dash along readily and swiftly both on the surface of the water and under it.

They are birds which inhabit closely by the banks of streams, rivers, and lakes, where there is abundant vegetation, consequently only in the low land or warmer parts of cold countries. At some seasons of the year they inhabit so very closely, that it has been often alleged that they migrate; but there appears to be no good ground for the allegation. If the rails and coots are separated, as they certainly ought to be, there are only two species, the common water hen and the sultana water hen, both of which are found in Europe, though the sultana is understood to be originally from Africa. These two agree in their habits, though not in their localities, or in their size and colours; and, on account of these differences, many authors have made them separate genera, restricting *Gallinule* to the common species, and calling the other *Porphyrio*. Both differ from the rails, and agree with the coots in having a horny plate or shield advanced upon the front, though not so conspicuously

as in the coots ; and they differ from the coots in not having the toes with broad and lobed webs, or any thing more than a simple projection of the skin along each margin. The whole structure of the feet, and the place of their insertion, are indeed quite different in the coot and the gallinule. The foot of the coot has the oblique motion of a swimming foot, and is articulated far backward ; the tarsus is flattened, so that it may be brought forward with less resistance of the water ; and the body of the bird is shaped a good deal like that of the goose. The body of the gallinule is more like that of a common fowl ; and though the feet are placed rather farther back than in birds which never take to the water, they are still walking feet ; and the long and elastic toes enable the weight of the body to be thrown far forward. They are, in fact, feet very admirably adapted to the places which the birds inhabit—tall and matted vegetation by the banks of the waters. The gallinule is of much more robust make than any of the rails ; its legs are much stouter, its toes more elastic, and the hind one especially much more produced, pointing out that it has to travel upon more yielding surfaces. The haunts of the bird, when compared with those of the species with which it has been confounded, agree exactly with the differences of structure. It is not so much in the water, or in so broad water, as the coots, and it is more so than the water rails.

THE COMMON GALLINULE (*Gallinula chloropus*) is the only British species. It is not very abundant, or at all events very frequently seen in any part of the country, but still it is pretty generally distributed both in the southern and the northern parts of the island. The general size is about the same as that of a pigeon, and the weight, when in fine condition, about a pound ; but at some seasons of the year it is very lean, and weighs much less, not above ten or eleven ounces. The length from the point of the bill to the extremity of the tail is about fourteen inches, and the stretch of the wings about twenty-one inches. The bill is greenish-yellow at the tip, and reddish-white at the base. The shield or plate, which advances on the forehead, changes its colour with the season. In the breeding time it is a brilliant vermilion colour ; but when the grand labour of the year is performed it changes to reddish-white. The head is rather small for the size of the bird, and it is black, with the exception of a white spot under each eye. All the upper part is dark olive-green, of very glossy lustre ; and the general colour on the under part is dull leaden-grey. The crest feathers are black ; those on the belly and thighs have the points dull white ; and there are produced feathers streaked black and white, which grow from the sides, and hang over the flanks and thighs. These last-mentioned feathers appear to act in some way as floats when the bird takes to the water. The hem of the wing, the margin of the tail, and some of the under tail coverts, are white. The garter, or portion of the tibia immediately above the tarsal-joint, is red ; but the tarsi and the toes are different shades of green and greenish-yellow, from which the bird gets its trivial name of *chloropus*, or “green foot.” The toes are very long, the middle front one measuring not less than three inches from the articulation to the point of the claw ; and they are very broad on their under surfaces, owing to the bordering margins being at that part.

The body is long, and has its principal cross dimension placed differently from that of those birds which

float on the water. These are generally broader than deep, and flattened on the under side, so as to present the greater base to the water, and thus float the more lightly altogether, and with the less pressure on the individual parts. The feathers are remarkably close, and their coats well supplied with down, especially on the under side ; their gloss is also such that the whole bird is water-proof, or at least can resist the action of that liquid for a considerable time.

During the day it lurks among the herbage on the banks of rivers and streams of running water, preferring those that have firm banks and clear currents to those that are stagnant and bordered with ooze. In the evenings it is more active, moving about in search of its food, which consists chiefly of small animals which in those moist places come out only after the heat of day is over. It also eats seeds and other farinaceous vegetable matters. In search of these it ranges the stubble fields, and at that season gets fat, and has its flesh much better flavoured than at other times of the year.

The nest is composed of a large quantity of withered reeds and rushes, closely interwoven, and the birds are particularly careful to have it placed in a most retired situation close by the brink of water ; and the female, it is said, never quits it without covering the eggs with the leaves of the surrounding herbage. Latham and Pennant say, she builds upon some stump of a tree which is only a short distance from the ground, or a shrub by the side of water : she may, no doubt, sometimes vary the place of her nest, according as particular circumstances may command, but she generally prefers the other mode of building it. She has commonly two hatchings in a season, and lays from six to eight eggs at a time. The eggs are irregularly and thinly marked with rust-coloured spots on a yellowish white ground, and are about two inches in length. The young brood remain but a short time under the nurturing care of the mother : but as soon as they are able to crawl out, they seek the water and shift for themselves. Although the water hen is no where numerous, yet one species or other of them is common in almost every country. It is not yet ascertained whether they migrate from this country to any other, but it is well known that they make partial flittings from one district to another, and are found in cold mountainous tracts in summer, and in lower and warmer situations during winter. On examination of several specimens of this bird, in full feather, they were found, like most birds of plain plumage, very little different from each other.

SULTANA HEN (*G. porphyrio*). These birds have been described as a distinct genus by several writers ; and they certainly have characters different from the common gallinule, though they approach much nearer to it than the rails or coots, with both of which it has been confounded. The characters are, whether we consider the birds as a species or a separate genus : bill strong, hard, thick, conical, nearly as deep as long, and shorter than the head ; the upper mandible dilated as it penetrates into the skull ; nostrils lateral, pierced in the corneous mass of the bill, nearly round and pervious ; legs long and stout ; the toes very long in some species ; the anterior quite divided, and edged with a narrow membrane ; wings of moderate dimensions. These birds, like the common gallinule, reside in or near fresh waters, haunt the extensive rice fields of the south, and prefer grain to aquatic herbs, their formidable bill being well adapted to

remove the husks, and break the straws, while their legs, and very long retractile toes are equally suited to lay hold of the stalks of the plant, and to carry the ears to their mouth. They move with grace on the liquid element, and run with equal facility on the ground, or on the leaves of water plants.

Various species, or varieties of the Sultana hen have been mentioned, but there is only one which is well known; and it must serve as a specimen. This one is, the purple water hen (*Gallinula porphyrio* of Latham). The upper mandible closely identified with the skull; the middle toe clawless, and longer than the tarsus; all the plumage blue, the frontal plate terminating behind the eyes. This definition is sufficiently characteristic of the beautiful species in question, which is nearly eighteen inches long, and about sixteen high, and which occurs on the marshy banks of rivers and lakes, and in the flooded fields of Calabria, Sicily, the Ionian islands, Dalmatia, the southern provinces of Hungary, and, though rarely, in Sardinia. It feeds on grain, plants, and roots, and is partial to fruit and fish. The nest is placed in the thick herbage of flooded or swampy fields, and is composed of bits of sticks and fragments of plants. The female lays three or four eggs. The Greeks and Romans tamed and fostered this interesting bird, introduced it into their palaces and temples, and allowed it a considerable range of flight. According to Sonnini it abounds in Lower Egypt, appearing in the rice fields in May, and the following months, and sometimes breeding in the deserts. The tibiae of the Sultana are naked much further up than those of the common gallinule; the tarsi are larger and very strong; and the toes are so much produced, as to bear an almost unnatural proportion to the size of the head. The body is handsome, however, and is wholly that of a land bird, so that it is probable these birds are not much in the habit of swimming.

GAMBOGIA—is the *Garcinia gambogia* of Desvauz, and the tree whence is obtained the yellow pigment called gamboge. The tree is large and handsome, the fruit is eatable, pulpy, and sweet; in the East Indies it is believed to be a provocative of appetite, and as such is much esteemed, and enters into the composition of many sauces. The resinous juices are obtained by wounding the bark, when they exude, and, becoming concrete on exposure to the air, the small lumps—the *gummi guttæ* of commerce, are collected for sale. The plant belongs to the natural order *Guttiferæ*.

GAMMARIDÆ. A family of crustaceous animals belonging to the order *Amphipoda*, and comprising the leaping shrimps, of which the genus *Gammarus* is the type. The body is compressed at the sides, curved, and composed of a series of equal sized segments, in which respects it is at once distinguished from the true shrimps and prawns, the anterior segments of which are soldered together into a large thoracic shield or shell, and as this structure prevails likewise in the lobster and crab families, these animals have obtained the names of shell-fish, although they have no more to do with the true fishes than any other perfectly distinct group of animals which happens to be aquatic in its habits. In the shrimps, lobsters, and crabs, moreover, we perceive only five pairs of legs, but the mouth is furnished with three pairs of foot-jaws. Whereas, in this family, and indeed in the other groups of sessile-eyed, hard-shelled crustacea (except the *Læmodipoda*), the body is furnished

with seven pairs of legs, attached in pairs to the seven segments succeeding the head; but the mouth possesses only a single pair of foot-jaws, so that it is quite evident not only that certain organs which, in the *Decapods*, are mouth organs, are transformed in the *Amphipoda* into legs, but also that the part of the body which, in the former, constitutes the head, is composed of several segments soldered together. It is to the inimitable researches of Savigny (which cost their talented author his eyesight) that we are indebted for the most satisfactory demonstration of these curious analogies, which we shall have occasion to allude to more at large in our article on **INSECTS**. The name, *Amphipoda*, is given to the group in allusion to another leading character, namely, that of having the legs of different forms, some of them, the anterior, being claw-shaped, and the others simple. Considerable variation, however, occurs in the form of the claws, and also in the particular legs which are clawed, and it is upon these, and various other structural characters, that the genera have been formed. In the typical genus, *Gammarus* (Latreille), the four anterior legs are formed into small claws, and the upper antennæ offer a character which is unique in the order, that of having a small articulated seta at the internal extremity of the third joint. The typical species, *Gammarus pulex* (*aquaticus*, Leach), is a small leaping animal, found in great quantities in ditches, ponds, and springs of fresh water, exceedingly active, and varying much in size. Its motions are effected in a manner similar to those of the spring-tailed insects, *Poduræ*, by bringing the tail, which is terminated by several appendages, beneath the breast, and then letting it go with force, thus giving, as it were, continual fillips to the water, in which it resides, and by which means it is impelled forwards. Another species is much more slender in its form, and its lower antennæ are very strong, and as long as the body. This insect forms the type of the genus *Corophium*, Latreille, which is further characterised by having none of the legs provided with a large claw. It is the *Cancer grossipes*, Linnæus, (*Corophium longicorne*, Latreille), and is about an inch long. It inhabits the coasts of various European countries, and is called *Pernys* by the inhabitants of the coast of La Rochelle, where it resides in holes, which it makes in the mud, covered with the wood-work erected by the muscle-catchers. The *Corophium* appears at the beginning of May, and immediately commences warfare against the *Nereids*, *Amphinomæ*, *Arenicolæ*, and other marine *annelida* which take up their abode in the same places. It is very curious to observe, at the rising of the tide, myriads of these crustacea swimming about in every direction, and beating the mud with their long antennæ, and turning it over, in order to find their prey. When they have discovered one of these *annelida*, often ten, or even twenty, times as large as themselves, several of them unite together to attack and devour it. They do not cease this warfare until they have thoroughly searched all the mud. They likewise attack mollusca, fishes, and even the carcasses of large animals left in the mud. They also ascend the hurdle fences inclosing the muscles, as well as upon the latter; indeed the muscle catchers pretend that they cut the threads which retain these shell-fish, so as to cause them to fall into the mud, so that they may the more easily devour them. They appear to multiply during the whole of summer, as the

females are found charged with eggs at different periods. The wading birds and many fishes devour them in their turn. They appear to quit the coast at the end of September, and almost simultaneously, for, at this time, not a single individual is often to be found in the places where they had only a few days previously swarmed. A more extended account of the muscle fishery of La Rochelle, and of the attacks of these insects, is to be found in the tenth volume of the *Encyclopédie Méthodique*, contained in a letter from M. d'Abigny to Latreille, and from which the above details are given.

Another curious genus in this family is *Cerapus*, of which an account has been already given. Amongst the other numerous genera, we shall only notice that of *Talitrus*, Latreille, in which the upper antennæ are very short, the lower long, with the terminal division annular, and the four anterior legs not distinctly claw-shaped. The typical species is *Talitrus locusta*, which is very abundant on our sandy shores, burrowing into the sand, and, unlike the majority of the order to which it belongs, seldom or never entering the water. It serves as food to many of the shore birds, which feed upon it with avidity. The following notice of its habits by Dr. Kidd, is from the *Entomological Magazine*:—"Under the sea-wrack, were shoals of that little jumping shrimp, with a large head, which is found upon nearly every coast; on lifting up a handful of sea-wrack, they swarmed and leaped about like fleas—some of them being scarcely bigger. These little fellows are the best anatomists in the world, in a single night they will turn a small animal into a more beautifully white and clean and perfect skeleton than can be obtained by any other means. They are of all sizes, from half an inch long to no size at all."

GANNET (*Sula*). A very interesting and highly characteristic genus of sea birds, belonging to Cuvier's order of *Totipalmæ*, or those which have the web, or swimming membrane, extended to the entire foot, and including the hind toe as well as the three front ones. All birds which have the feet of this structure, have them turned obliquely inward, so that they have an awkward appearance when on the ground, and the birds have an ungainly and wriggling walk. They are remarkably well adapted however for rising from the surface of the water, which is an action that these birds often have to perform, as the whole of them subsist chiefly by fishing, and by dashing down from the sky on their prey, and not pursuing it in the water, as is the case with the diving birds.

The following are the characters of the genus: the bill straight, slightly compressed, pointed, and a very little arched at the point; the edges are lined with small teeth, which are inclined backwards like barbs. The nostrils are nearly closed, and capable of being entirely so; the throat is naked, and is covered with black skin, which also extends round the eyes, has much the appearance of Indian-rubber, and like that substance is very extensible; the claw of the middle toe is toothed like a comb; the wings are long, though perhaps not so much so in proportion as they are in some of the entire-footed birds, which range the wide and fertile expanse of the tropical seas. They are timid birds, and peaceable and inoffensive in their manners; and they are at the same time heedless of the approach of danger. On this account they have had such names as "fools," and "boobies," bestowed upon them; but all such epithets given to

animals are absurd; *man* is the only member of the animal kingdom that is, or that can be, a fool.

There is only one species known in the British seas; and that is the only one of which the characters are ascertained with any thing like accuracy, and to which the name "Gannet" applies. To it, therefore, our present notice must be chiefly confined.

The common Gannet (*Sula Bassanus*), which is also called the Solan goose, (which is only an incorrect pronunciation of "Sula goose," the name of the bird on the coast of Norway and in the Faroe islands,) is remarkable for the vast numbers in which it assembles on some parts of the British shores during the breeding season. The lofty rock of the Bass in the Frith of Forth, Ailsa Crag in the Frith of Clyde, and many of the detached rocks and lofty headlands along the northern and western parts of Scotland are so thronged with these birds in the season, that they appear as if covered with snow.

The full grown gannet weighs about seven pounds; it measures about three feet in length, and six feet in the extent of the wings; the bill is nearly straight, except towards the point, where it declines a little, and is about six inches in length; the edges of the mandibles are a little jagged irregularly and sharp; the colour dirty yellowish white; near the base of the upper mandible is a sharp process and suture, which enables the bird to move it a little in the act of swallowing large fish; there are two longitudinal grooves along the sides, running the whole length, but no nostrils; the irides are pale yellow; the skin is bare round the eyes and of a bluish colour; the chin is of a dusky colour, destitute of feathers, capable of great distension, and forming a kind of pouch; except the crown of the head which is buff colour, the whole plumage is white; the tail feathers are strong and pointed, and twelve in number; the bill is of a bluish grey colour, when alive; the legs are of a dusky colour, singularly marked, with the front bluish yellow, which divides at the feet, forming a line of the same colour; along the ridge of the two front toes, the united membrane is unusually strong, and almost as transparent as glass.

The northern regions of the two continents are the chief haunts of this species. Individuals are observed in hard winters, on the coasts of England, France, and Holland, but they breed abundantly on the Bass island, in the Frith of Edinburgh, on Ailsa, off the coast of Ayrshire, the Sketting isles, on the coast of Kerry in Ireland, the islands of St. Kilda, Shetland, Orkney, Faroe, &c. In the summer season the rocks of St. Kilda are quite covered with these and other sea-birds, and appear at some distance like hills covered with snow. In the Orcadian and Shetlandian seas, although common, the gannets of that range chiefly breed on the stack "Sula's Skerry." In those districts which we have just mentioned, the gannet arrives in March, and remains till September; nor is it known in this hemisphere to breed much further south than the coasts of Scotland. Some few of them remain about their breeding stations all the winter, but they are supposed to be the old ones, which are unequal to the distant flight undertaken by the others. They do not depart or arrive all at the same time. A few of the forerunners are first seen about the Bass; and a short time afterwards the main body follows in several successive divisions. As this bird must, previously to taking wing, let itself fall, it requires a steep and precipitous breeding place. From

a considerable height it observes its prey, and darts upon it with amazing velocity and force : its nest is a rude and large assemblage of all sorts of materials, as it lays hold of any thing fit for the purpose, whether on the land or floating on the waters, as grass, sea-weeds, shavings of timber, shreds of cloth, and frequently articles picked up at a very considerable distance, or else from the nests of its neighbours. The female lays two eggs, but occasionally only one, which are white, of a rough surface, a long shape, and remarkably small for the size of the bird, being scarcely larger than those of a duck. The male and female incubate, and by turns go out fishing. It is reported currently, though erroneously, that they not only hatch their solitary egg by means of their foot, but that they place it on one end in such a manner, that if a person overturn it, he cannot make it stand as before. Dr. Harvey, the celebrated naturalist, who visited the Bass, and has described it in very elegant latinity, strangely enough asserts the latter circumstance. Under their bill, in the dilatable skin, these birds can fetch four or five herrings at a time, besides sprats, which the young extract from the mouth of the parents, with their bill, as with pincers. The young are begun to be taken in August, and are relished by some as a delicate morsel, but the older ones are tough and rancid. The fowler who seizes the young, is often let down by a rope, from the top of a cliff, and is sometimes stationed on the slippery projection of a rock, with a perpendicular precipice of more than 400 feet beneath him. About New Holland and New Zealand, gannets are said to be met with in great abundance. On the coast of Newfoundland they also breed, and migrate southward along the American shores, as far as South Carolina. They unite in small flocks of from five to fifteen in number, when they pass from one place to another ; and except in very fine weather, they fly low near the shore, doubling the capes and projecting parts, and keeping nearly at an equal distance from the land. They rise high into the air during their fishing, and sail aloft over the shoals of herrings and pilchards, much in the same manner as kites. When they observe the shoal thickly crowded together, they close their wings to their side, and precipitate themselves head foremost into the water, dropping almost like a stone. In this act they never fail to rise with a fish in their mouth, their eye being so correct.

The following account given by the late colonel Montagu, of the habits and structure of the gannet, is interesting as among the most circumstantial that has been published, more especially as the veracity of the narrator is above all question : " A gannet," says colonel Montagu, " was brought to us alive on the twentieth of March, in the year 1807 ; it took no kind of food for seven days ; it was then crammed with both fish and flesh, and soon after began to devour all white fish greedily, but did not choose to pick up even a plaice when the back was uppermost. It was remarked, that when the bill was held so as to close the mandibles for a considerable time, respiration became laborious, there being no nostrils. When the bird was placed on the water of a pond, nothing could induce him to attempt to dive ; and from the manner of his putting the bill, and sometimes the whole head under water, as if searching for fish, it appears that their prey is frequently taken in that manner. It is probable more fish are caught in their congregated migrations, when the shoals are near the surface, than

by their descent upon wing ; for the herrings, pilchards, mackerel, and other gregarious fishes, cannot at that time avoid their enemy, who is floating in the midst of profusion. In the act of respiration, there appears to be always some air propelled between the skin and the body of this bird, as a visible expansion and contraction is observed about the breast ; and this singular conformation makes the bird so buoyant, that it floats high on the water, and does not sink beneath the surface, as observed in the cormorant and shag. The legs are not placed so far behind as in such of the feathered tribe as procure their subsistence by immersion ; the gannet, consequently, has the centre of gravity placed more forward ; and when standing, the body is nearly horizontal like a goose, and not erect like a cormorant.

" Having, by the dissection of a specimen of the gannet for preservation, noticed the slight and partial adhesion of the skin to the flesh of the whole under parts of the body, we availed ourselves of the opportunity of paying more attention to the structure of this bird, and, by experiments, endeavoured to discover to what extent, and upon what principle, the inflation of the body was performed. The appearance of so singular a conformation, brought to recollection what Buffon relates of the pelican ; who remarks, that from the lungs the air passes through auxiliary pipes into a thick vesicular cellular membrane, that covers the muscles and envelopes the body. The structure, however, of the gannet, although probably intended for similar purposes, is very different from that of the pelican, according to the relation of that naturalist. The bill of the gannet differs from that of most birds, for it is not only destitute of nostrils, but on each side of the upper mandible, towards the base, is a dentation that divides the margin, and thus admits of considerable motion. It has been customary to describe the gannet as possessing a large pouch, like the pelican, under the chin, capable of containing five or six herrings ; but this is erroneous. The gullet (*œsophagus*) is extremely capacious, and the skin, from the chin downwards, extending along the neck, is equally capable of dilation, so that five or six fishes, equal in size to that of a herring, might be contained in the gullet and stomach ; for there appears to be very little difference between them ; or, in other words, the stomach is a continuation of the gullet (*œsophagus*), with little or no stricture or division.

" It is well known that many birds regurgitate with much ease and facility ; and that instinct points out to them the necessity of preparing the food intended for the nourishment of the young in the receptacle, usually termed the craw : in this manner the gannet, having none, can readily disgorge the contents of its stomach to satisfy its young. By comparative anatomy it has been clearly demonstrated that birds in general are provided with air vessels in different parts of the body, and that many of their bones are not destitute of this contrivance, admirably fitted for increasing their levity, and consequent buoyancy, as well as progressive motion through that element in which they are intended principally to move ; and that, too, with a velocity that far surpasses all other parts of animated nature. Mr. John Hunter (in the Transactions of the Royal Society) proves that the air-cells, in the parts already mentioned, have a free communication with the lungs, by means of openings on their surface, through which the air

passes readily into them : and it clearly appears there is no *diaphragm* that confines the air to the regions or cavity of the breast, but that the whole of the abdomen is equally inflated by inspiration through the lungs. Thus far have the scientific researches of that anatomist contributed to our knowledge on this subject. No one appears to have noticed the phenomena attendant on the construction of the gannet, or to what further extent this circulation of aerial fluid is carried in some particular species of birds ; a circumstance which demands our highest admiration, when we contemplate the advantages of such a structure, in conducing to the comforts, and perhaps to the very existence, of these kinds of animals.

“ Several gannets having been subjected to artificial inflation, we shall state the result, and relate the manner in which the experiments were pursued. A pipe was first introduced into the wind pipe (*trachea*), and when air was propelled through it, the whole internal cavity of the body was inflated, but no air passed into the external cells between the skin and the body. An incision was then made into the lower part of the abdomen into the body, very near the vent, into which the air was forced through a pipe ; the pipe in the windpipe (*trachea*) having been previously stopped, and a similar inflation ensued, without affecting the exterior cells. The pipe was now removed from the windpipe (*trachea*), and upon the air being propelled with force through the pipe near the vent, it readily found its way through the *larynx*, producing a noise similar to the sound emitted by the living bird. A small opening was then made in the skin, on the left side, about midway between the wing and the thigh, and a pipe introduced, having stopped first those directly communicating with the internal parts. It was now obvious that when air was forced through this orifice, the skin on that side, as far as the middle line of the body, was greatly inflated, extending into the lower part of the neck, along the larger joints of the wing, down the thigh, and also into the cavity of the body ; but the right side was not in the least affected. The pipe at the *trachea* being now removed, the air produced a similar effect upon the *larynx*, as before mentioned, but not so loud. Still suspecting that there was a communication between the sides, by means of some valvular apparatus, the right side was subjected to the same experiment ; the result, however, negatived our expectation, the effect produced being similar in every respect.

“ From a repetition of these experiments upon several subjects, it became evident that there was a communication between the lungs and the cellular membrane that covers the greater part of the body, as well as with the whole cavity of the body, but that, on account of some valvular contrivance, the skin could not be artificially inflated through the lungs, although air would readily pass in a contrary direction. It is also clear that there is no direct communication between the sides. In order to examine this extraordinary structure, we made a longitudinal incision the whole length of the body, a little on one side of the keel, or what is commonly termed the breast bone ; by this means the membrane that connects the skin to the body, and cuts off the communication between the sides, was easily examined ; but nothing was observed indicating that a communication could be effected, even at the will of the bird. On each side, nearly equidistant between this pectoral membrane and the back, is situated another

longitudinal one, very similar to the last, but perforated ; between this and the pectoral are about nine irregular transverse membranous septa, that hold the skin firmly to the body, having a free communication with each other. The skin is also furnished with a transparent cellular membrane, the cells being regularly perforated close to the base of each feather. At the upper part of the breast is a large bag, which extends some way up the neck ; this is attached to the skin by the septa of innumerable small cells, but no opening into this cellular bag could be discovered ; the introduction, however, of a small pipe through an artificial aperture, clearly demonstrated a passage to the lungs, as the whole internal cavity of the body was inflated, and the air issued from the *trachea*. Upon opening this bag, the passage of communication with the internal parts appeared to be under the shoulder-blades (*clavicles*), as a thin perforated membrane was perceived at the bottom, leading to the thorax, not directly into the lungs, but near the part where the *trachea* divaricates, and afterwards communicating with the lungs. It could not, however, be discovered where the air could find a passage from the great magazine into the cellular bag, and yet there is every reason to conclude that at this part some valvular passage must exist.

“ Pursuing our researches, we observed at the bottom of each lobe of the lungs a considerable opening for the passage of air into the cavity of the body. But what arrested our particular attention was a wonderful provision of nature for the protection of the vital parts, by guarding the *viscera* with a strong integument that preserves them in a proper degree of moisture, and contributes to the due secretions for lubricating those parts, so essential to the functions of their delicate nature, which might otherwise be too quickly carried off, by the constant circulation of fresh air that nearly surrounds them ; for this integument is held only by ligaments to the back and front, leaving all other parts free for inspired air. The liver and intestines are firmly attached to the surrounding integument ; the heart is enveloped by a similar covering, which is only partially connected to the common one. In the *trachea* nothing very remarkable occurs, except two small glands, about the size of a pea, at the lower extremity. The tongue is so extremely diminutive, as scarcely to be entitled to that denomination. The *clavicles*, or what is commonly called the merry-thoughts, which are usually affixed to the point of the keel of the breast-bone by a ligament, is in the gannet so firmly united as to appear a part of it. From what has been already observed, it will not be unreasonable to conclude, that the gannet is endowed with such singular properties, for very different purposes than those of long and continual immersion, of which we have before stated it appears to be incapable. But such a power of inflation must contribute greatly to lessen the concussion in its rapid descent upon water, in order to seize its prey. Besides, as the enlargement of the surface, without materially adding to the specific gravity, must greatly contribute to its buoyancy, both in air and water, it is well adapted for residing in the midst of the most tempestuous sea, floating on its surface in perfect security, and following those shoals of fishes on which depends its whole existence. Thus, when all other birds are compelled to seek shelter in bays and creeks, the gannet is enabled to

brave the severest weather in all seasons, without attempting to near the shore.

"This contrivance may also be of the most important service to an animal which is constantly exposed, even in the most inclement seasons, and cannot quit its station without starving. Nothing could possibly conduce more to its security against intense cold, or be better adapted to preserve the necessary temperature of animal heat, than the intermediate air dispersed between the skin and the body, since that element is found to be a non-conductor of caloric. Upon this principle, what animal can be more securely protected against cold, or retain its vital heat so effectually, as the gannet, or such birds as are almost surrounded with a body of confined air, divided by cells, and intersected by membranes between the skin and body, and that skin so amply covered with a light porous substance, filled also with air, and impervious to water? The gannet is capable of containing about three full inspirations of the human lungs, divided into nearly three equal portions, the cellular parts under the skin on each side holding nearly as much as the cavity of the body. Now, as a full or extraordinary inspiration of the human lungs has been considered to occupy a space of about sixty cubic inches, so the gannet is capable of containing not less than one hundred and eighty cubic inches of air at one time, subject to the will of the bird, under certain impressions."

The following account of this very singular organisation of the gannet, which, though possessed in common with the cormorants and some others, is yet so much more remarkable in the gannet as to be deserving of particular attention, is from the observation of Messrs. Owen and Yarrell, read to the Committee of Science of the Zoological Society in 1831. "In the examination," say these able comparative anatomists, "our attention was chiefly directed to the air-cells, which, in this bird as in the pelican, have a most extensive distribution. We commenced by gentle but continued inflation through the *trachea*, a pipe having been introduced into the upper *larynx*: in a short time the integuments of the whole of the lateral and inferior parts of the body rose, and the air-cells seemed completely filled, especially that which is situated in front of the *os furciforme*. Being thus satisfied that they all had a free communication with the chest, we next proceeded to see at what points these communications took place, and in what degree the air-cells communicated with each other. For that purpose the air-cells on the left side of the body were laid open, and shortly after those of the opposite side collapsed, indicating the existence of apertures of communication, although the *septum* which ran along the middle line of the body appeared at first sight imperforate. There was a free communication between the lateral air-cells of the same side of the body from the *os furciforme* to the side of the *pelvis*; but the air-cells in front of the *os furciforme* remained still tensely inflated. The lateral air-cells had a free communication with the cavity of the chest at the *axilla*, at which part the air had entered these cells during the inflation. The pectoral muscles and those of the thigh presented a singular appearance, being, as it were, clearly dissected, having the air-cells extended above and below them; the axillary vessels and nerves also passing bare and unsupported by any surrounding substance through these cavities. We traced the air-cells down the side of the *humerus*,

ulna, and metacarpal bone, into all of which the air entered, and even into the bone corresponding to the first *phalanx*, which agrees with what Mr. Hunter has described in the pelican. As none of these proceedings had any effect on the air-cells in front of the *os furciforme*, which still continued distended, it was evident that inflation by the *humerus* could not have filled it, except through the medium of the lungs themselves. We next proceeded to detach the integument from this air-cell, to see its shape and extent; this required to be done with great care, as it adhered pretty closely to the skin and roots of the feathers: it was of a globular form, about four inches in diameter, and communicated with the *thorax* at its anterior aperture below the *trachea*. Numerous strips of muscular fibres passed from various parts of the surface of the body, and were firmly attached to the skin; a beautiful fan-shaped muscle was also spread over the external surface of the air-cells anterior to the *os furciforme*. The use of these muscles appeared to be to produce instantaneous expansion of the air from these external cells, and by thus increasing the specific gravity of the bird, to enable it to descend with the rapidity necessary to the capture of a living prey while swimming near the surface of the water. With respect to the general anatomy of this bird, it may be observed that we found the two glands at the termination of the *trachea*, which are noticed by Montagu, and which exist in addition to the ordinary pair lying above the *bronchiæ*. The stomach corresponded exactly with the figure given by Sir Everard Home (*Comp. Anat.*, p. xlvi.), the pyloric orifice being provided with the bilobed valve, which is there represented, though not described in the text; it evidently opposes a too ready egress of the contents of the stomach."

We have given these observations in the words of the observant authors, and we shall not point out the small discrepancies which might perhaps be found, upon examining what those first quoted have said, with an eye of severe criticism. The fact is, that there is no part of the animal structure of the real use of which we know less, than of that power which some animals have of inflating their bodies in whole or in particular parts. The air under the skin of the thorax in the gannet must render the whole body of the animal more buoyant, and as little can there be any doubt that it can take off the concussion which the bird would otherwise experience when it plunges down from a height upon its prey; and that it has some pretty severe labour to perform, is almost a necessary inference, from the strength of the skin and its internal membrane, and the number of points at which it is tied to the muscles, the keel of the sternum, and other parts. But it is rather too much to assume that this apparatus has any thing to do with the preservation of temperature in the bird. There is no such provision in the whole animal kingdom. If dry cold is to be guarded against, that is, cold in which water does not reach the skin, then fur and down are the provisions; and if moist cold, the protection usually consists of a layer of fat under the skin, the latter theory of its action is what is most likely; and when we consider what injury the human body may receive by plunging into water from a height of not more than twenty or thirty feet, we can at least guess at what the gannet encounters, when it not merely falls, but shoots down with an impetus from more than ten times the height. The gannet always

meets the water with the breast in its plunges, because the head penetrates with little resistance ; and the elapsed time between seeing the prey and seizing it must be the least possible. Altogether the gannet is far more a bird of the mere surface of the water than any other of the entire-footed birds which plunge down upon aquatic prey. Altogether it is one of the most interesting of our shore birds, both in its own appearance and habits, and in the character of those places where its countless myriads take up their abodes. No one should visit the wilder parts of our shores without some previous knowledge of the gannet. The gannet is eaten, but it is both tough and rank. In some places it is eaten in order to whet the appetite, in which case it is salted and smoked.

The Common Booby (*Sula communis*) is not so interesting a bird as the gannet. It is larger than a common duck, but less than a goose. Its body is greyish-white, with black tips to the quills, and the tail brownish ; but it is very subject to varieties of colour. It ranges over the whole Atlantic, from the confines of the polar ice to the equator. It is a very fearless bird, and so familiar, that if it is fatigued by being long on the wing, it will alight on the hand, and allow itself to be taken. It is, however, pretty safe from the effects of human cupidity ; for its flesh has so rank a taste, that men must be reduced to the greatest extremity before they can prevail upon themselves to eat it.

GARCINIA (Linnæus). A genus of beautiful fruit trees, natives of Malaya and the neighbouring isles. It belongs to *Dodecandria monogynia*, and to the natural order, *Guttiferæ*. Generic character : calyx of four sepals, persisting ; petals four, roundish, concave ; stamens seated below the germen, nearly united at the base ; anthers oval ; style none ; stigma from four to eight, lobed ; berry four, six, or eight celled ; each containing one seed.

The *G. Mangostana*, or *mangosteen*, as it is frequently called, is one of the choicest fruits, being the most delicious, and, at the same time, the most wholesome. It is about the size, and has much the appearance of a large pomegranate, consisting within of a soft, transparent, juicy pulp, in which the flavour of the grape and strawberry are combined. The plant is in our stoves, where it grows freely in light loam and moor earth, and kept in a strong heat. Ripened cuttings strike roots in sand under a glass, in moist heat.

GARDEN BALSAM. is the *Balsamina hortensis* of Rivinus, formerly the *Impatiens balsamina* of Linnæus. This is a well-known ornamental plant. They are raised annually from seed sown in a hotbed in March, and afterwards placed and nursed in pots till they flower.

GARDENIA (Linnæus). A genus of beautiful evergreen shrubs, natives of China and other places in the east. Class and order *Pentandria monogynia*, and natural order *Rubiaceæ*. Generic character : calyx, in five divisions ; corolla, salver-shaped, tube cylindrical, segments of the limb oblique ; anthers, sitting ; stigma, two-lobed ; berry two celled ; seeds in several series. This genus is much valued by collectors ; their beautiful white flowers and rich scent, particularly the double and single *G. Florida*, are among the choicest of Chinese plants, and much care is bestowed in bringing them into flower. They are propagated by cuttings.

GARLIC, is the *Allium sativum* of Linnæus, a well-known culinary plant. See **ALLIUM**.

GASTERIA (Haworth). A genus of succulent plants, natives of the Cape of Good Hope. The flowers are hexandrious, and the genus is arranged in the natural order, *Hemerocallideæ*. Generic character ; corolla tubular, nectariferous at bottom, limb regularly six cleft, or somewhat gaping ; stamens inserted into the receptacle ; anthers oblong and incumbent ; style simple ; stigma three-lobed ; capsule three-celled, three-valved, with a central placenta ; seeds three-sided, or compressed and winged. These plants were formerly associated with the aloes, but have been separated by Duval and Haworth. They are grown in sandy earth and lime rubbish, and require but little water, as their leaves are very thick and fleshy.

GASTEROPHILUS (Leach). A genus of parasitic dipterous insects inhabiting the stomach of the horse, belong to the family *Æstrideæ* ; the grubs or larvæ of which are ordinarily termed Bots. See the article **BOT**.

GASTEROPODA. Lamarck's fourth order of molluscs, including all the animals, having straight bodies, never spirally formed, or entirely concealed in a testaceous covering. They possess a muscular disc under the belly, attached to the body, nearly its whole length, which acts as a foot in progressive motion, and gives rise to the name of the order.

GASTROPTERA (Meckeli). A naked mollusc, whose body appears divided into two parts, the posterior globular, merely, as it were, connected by peduncles to the anterior, which is very small, enlarged on either side into a large muscular expansion, transversely oval, slightly grooved backward and forward, which renders it as if bilobated, and, acting as a foot, serves for the purpose of swimming ; the lateral bronchia are altogether exposed. It is found in the seas of Sicily, and is probably the species described by Rafinesque, under the name of *Sarcopterus*—meaning fleshy wings. *Gasteroptera* means wings on the belly. Those naked molluscs, occupying formerly a separate existence in the system of natural history, almost totally unconnected with shell-bearing molluscs, presented no interest beyond the wonderful and beautiful organisation they exhibited ; by the present combination of them in the general arrangement of Malacology, they serve as illustrative links, which prove, beyond all manner of doubt, the propriety of adopting a system based upon the immutable wisdom of Nature's architect. The French naturalists have placed this genus in the fourth family, *Akera*. Third order, *Monopleurobranchiata*. Second class, *Paracephalophora*.

GASTRODHÆNA. A genus of *Molluscs*, established by Spengler ; the shell is equivalve, somewhat wedge-shaped ; the anterior opening oval, oblique, and very large ; the posterior one nearly closed ; the hinge is linear, without teeth, and marginal. This mollusc penetrates hard substances in the manner of the pholas. It seldom exceeds half an inch in length, and inhabits the British coasts.

GAULTHERIA (Linnæus). A genus of small evergreen shrubs, natives of North America, Nepal, and New Zealand. The flowers are decandrious, and belong to *Ericææ*. The *G. procumbens* is a very common plant in American borders, requiring a moor-earth soil, where it propagates itself abundantly.

GECARCINUS (Leach). A genus of land crabs, belonging to the *Decapod Crustacea*, and section *Quadrilateres* of Latreille, having the body somewhat square, the third and fourth pair of legs longer than the second and fifth, and the antennæ concealed by the front of the carapace or shell; the second and third joints of the outer foot-jaws are large, flattened, and curved. The typical species is the *Cancer ruricola*, Linnæus, a native of the West Indies, and generally known under the name of the violet crab, or *Tourlourous* of the French. They reside in the mountainous districts, but as soon as the rainy season sets in, in May and June, they make their way to the sea, in order to deposit their spawn in the water, in such vast numbers that the roads are covered by them. They resemble a vast army marching in battle-array, keeping steadily onwards in a direct line, without allowing any obstacle to impede their steps, scaling even the walls of houses which happen to be in their route, and travelling chiefly by night. When arrived at length at the sea-shore, they are much enfeebled, and dash into the water with great eagerness, which they repeat several times; they then retire to some neighbouring wood or other covert, and, in a short time afterwards, the females again return to the water, and commit their eggs to the waves, which are alive with fishes waiting for this annual treat, and by which a very great deal of the spawn is devoured. The crabs then return to their old quarters by the same route, but this, in their still enfeebled state, is a difficult task. When arrived there, however, they have to undergo another annual labour, namely, that of moulting, and which takes place in their subterranean burrows, the mouths of which, it is said, they close. See further the articles **CRAB** and **BRA-CHYURA**.

GECKOIDÆ, **GECKOS** (*Ascalabota*). The fourth family into which Cuvier divides the saurian or tailed reptiles. They are, strictly speaking, the nocturnal lizards, and they may all be included in one genus, though the species, which are very numerous, differ from each other in so many particulars that they admit of arrangement into several sub-genera. Their relations to the other families of the order and orders of the class will be found detailed in the article **REPTILE**, in its place in the alphabet.

Their form is not so light, nor their motions so volatile, as those of the true lizards. They are flattened, especially in the head, which gives them a heavy appearance, and their motions are dull and crawling. Their feet are of mean length, or rather short, and their toes are of nearly equal length, and often peculiarly formed. As is the case with all nocturnal animals that seek their prey chiefly on the surface of the earth, their eyes are very large, and the pupils close on vertical lines as in the cat. Their eyelids are small and drawn in between the eyeballs and the orbits, which gives them a very singular appearance. Their tongue is fleshy, and not extensile beyond the mouth. Their jaws are furnished each with one row of teeth, very small in size and closely set; and they have no teeth on the palate. Their skins are covered with small granulated scales, like shagreen, but these are interspersed with larger tubercles, and the scales on the under part are generally of a larger size and imbricated. Some of the species have pores upon the thighs, and others have not; the tail has circular plaits or folds, as in the genus *Anolis*; but when it is once broken

off, the new tail which grows in its place is destitute of folds, and also without tubercles in those species which have the original tail tuberculated.

Reptiles of this genus inhabit the warmer regions of both continents, and the species are very numerous. The appearance of these animals is peculiarly loathsome; they not only inhabit places which are dark and obscure, but those which are rank and offensive; and as they bear no inconsiderable resemblance to toads and salamanders, they have had the stigma set upon them of being venomous. That it poisons by stinging or biting, or any other species of offensive apparatus, or instrument of attack, is not true, and cannot be true, of any species of gecko; for none of them possesses a sting of any description, and the teeth in all are so very minute that they are incapable of penetrating the skin of any animal of moderate size. That some of them discharge a poisonous liquor is, however, well understood, but this liquor is discharged from pores in the feet; it is of so very virulent a nature as to inflame or even blister the skin when they run across it; and it is particularly dangerous to those who have eaten any provisions over which these animals have passed. The poison of the geckos appears, therefore, to be very similar to the poison of some species of toads; being in both an exudation from the skin, and not appearing to be, generally speaking, a means of capturing their prey, or of attacking any other animal, as is the case in animals which have stings or poison fangs. This circumstance, together with the toad-like aspect and clumsy gait of these creatures, is in all probability the reason why they are looked upon with so much aversion by most people; and this is, no doubt, also further increased by the foul places in which they reside, and their nocturnal habits.

Offensive as they are, however, they are not entirely useless, even in the domestic economy of those places where they are most abundant. These are, as we have said, the warmer regions both of the eastern continent and of America; and if the greatest domestic cleanliness is not observed in such places, the habitations of the people are very much pestered with spiders, and also with a variety of insects, both winged and crawling. Such of the winged ones as are diurnal in their habits are, in a state of repose, in holes and crannies during the night; and it is at this time that the nocturnal ones crawl abroad. These minute creatures constitute the principal food of the geckos, which seek after them with so much assiduity that in many places where the habits of the people are slovenly, they are encouraged for the purpose of keeping the houses as clear of the others as possible, though, according to our notions of domestic cleanliness, the cure would be considered as even worse than the disease.

The toes of the geckos are generally bordered with membranes for the whole or the greater part of their length. The under sides of them are generally covered with regular rows of small scales, the edges of which take a very firm hold of the substances over which the animal passes. The toes, with the exception of the thumb or inner toe, which is very small in some of the species, are also, as has been said, of nearly equal length; and they spread as it were from a centre, something in the same manner as the rays of a fan, from which structure they become double grasping feet, or what may perhaps be termed "crab feet," which can hold on upon very slight inequalities,

not only on the upper sides of bodies, but also on the perpendicular and even the under sides. By means of this peculiar structure of the feet, and not by suckers as has sometimes been supposed, they can contrive to make their slow march a very sure one on all sorts of surfaces where they are likely to find their food. They can crawl up the walls of houses, and also along the roofs and ceilings with their backs undermost, though it is possible that in the latter case they are assisted by the peculiar structure of their claws; and yet the mechanism of those claws would lead one to suppose that they are used for other purposes. They are hooked and very sharp at the points, and also retractile, something after the manner of the claws of cats, so that in the ordinary march of the animals they do not touch the ground. This renders it probable that their points are preserved in order that they may assist in some way in capturing their prey; and it is at least possible that the acrid liquor with which the feet are provided may assist in this operation; but this point, like the habits of the animals altogether, is not a little obscure.

The peculiar structure of the feet in the geckos renders it very doubtful whether any animal, at least any vertebrated animal, makes use of suckers upon the feet as a means of progressive motion. The mechanics of nature, though in every respect superior to the mechanics of human art, never violate any well established law of mechanical action. It is not indeed to be expected, or indeed to be believed, that they could in any way do this; for our laws of mechanics, as established from experiments on dead matter, are not only of the same class but perfectly identical with the same laws as they obtain in the living world. That this must be the case may be seen by a moment's consideration. The living animal, or if the expression be preferred, the principle of life in an animal, has to contend with exactly the same kind of difficulties, and overcome exactly the same kind of resistances as we have in our mechanical operations. The properties of matter, considered as such, are the same in both cases; and there is much less difference between an animal balancing or suspending its whole body or any particular part or organ of it and one balancing or suspending any piece of matter, than would at first be supposed. The doctrine of the centre of gravity, and the combination of pressures and resistances, are the same in the one case as in the other; and the only difference consists in the superior construction of the animal's apparatus, and a greater certainty with which that apparatus can be applied.

This is a very beautiful, and far from an uninteresting part of the science of natural history; and if the describers of the actions of animals had always been well informed in those mechanical principles, which have been established by experiment or by mathematical demonstration, before they had proceeded to their professional labours as naturalists, the books on this most interesting subject, in its most interesting branch, would not have been so replete with error and absurdity, and assumption in violation of all mechanical principle, as we too frequently find them.

We are distinctly to understand then, that the labour which an animal has to perform by means of the structure of its body, is precisely the same in kind with that which we have to perform, in balancing, supporting, and moving from place to place, those pieces of matter which we do so act upon,

either as parts of our machinery, or for other purposes. But between us and our machine considered on the one hand, and the life and organisation of the animal considered on the other hand, there is a very remarkable difference. Our materials and our art are separate from each other; and we have to learn the means of using from the nature of the thing used and the use intended. We never can be sure how far even our best information may fall short of what there is to be known respecting any one material, and therefore our very best art is a second rate species of bungling, as compared with that displayed by the most apparently simple and humble animal. The reason is, that in the animal the living principle elaborates its own organ, or at all events the two originate and come to maturity in so close union with each other, that we cannot separate them even in imagination. If we see even a detached part which we believe to have once belonged to an animal, as a bone, a shell, or any thing else, even though that bone or shell remains only in form and the substance has become a species of stone, or a petrification as we call it, we can no more refer that remain to any other than an animal organ, than we can say that a block of granite or a bar of iron is a product of life, or remain of some strange animal of antediluvian years.

Carrying this principle with us, and viewing the peculiar structure of feet and the ordinary rate of motion in the geckos, we can hardly fail in feeling some doubt as to the accuracy of the common motion of animals, and those, generally speaking, much swifter footed animals securing their footsteps by means of suckers. This is tolerably well made out by the analogy. The placing of the sucker so as that it would lay hold, and the removal of it again after the hold is taken, requires some time, as we may perceive in leeches and animals which usually perform their march by means of suckers, when they are out of the water and incapable of swimming. The sucker is never in them a point of momentary rest, from which they are thrown by an impetus of recoil, in the same manner as a walking animal is thrown into progressive motion by the recoil of its feet touching the ground. The posterior sucker serves as a point of resistance, from which the whole body of the animal is pushed forward by being elongated, and this takes some time, so again the anterior sucker is an instrument of prehension, by means of which the animal holds on until it draws up the length of the body to a very small fraction of what it previously had; and when the greatest contraction is made, and the posterior sucker again fastened, the anterior part of the body is again advanced, and the motion is continued by those curious steps as long as the necessity of the animal may require, or its ability admit. Nor do we know any fully established instance in which suckers are used as even fulcra of motion, except by annulose animals which have the power of alternately lengthening and shortening their whole bodies in order to produce motion, instead of having separate organs for that purpose, as is the case in all vertebrated animals, however different those organs may be in form, or however rudimental in some cases.

If any saurian reptile, or other vertebrated animal, were to have suckers as instruments of motion, the geckos are unquestionably the animals with whose habits, according to all that we know on the subject,

they would best agree ; and we may add that, of the whole race they appear to be the ones in which such organs, if they could be usefully applied in walking, would be most essential. The march of these creatures is very slow ; it is taken over many kinds of surfaces, and surfaces placed at all imaginable angles to the horizon ; and as the sucker in the common descriptions of it is understood to act by atmospherical pressure, which is of course equal in all directions, it would of course be equally serviceable to the geckos, when back uppermost on the floor, back undermost on the ceiling, or ascending or descending the wall. If the sucker were the best apparatus for this purpose we may rest assured that the gecko would have it ; but it has no such provision ; and the rows of scales upon the under surfaces of its toes, and their marginal membranes, are quite incompatible with a perfect expulsion of the air from under the foot. It is possible, however, that those margins, whether they extend wholly or partially along the toes, may act as lateral branches of the toes, and press downward by muscular action, so as to enable the under surface of the foot to embrace more of the asperities of the surface along which the animal walks ; and the scaly irregularities upon the under side of these feet are so very numerous that it would not be easy to say at how many points of a surface one foot at the same instant lays hold.

The subject of climbing, and walking, or running with the back undermost in animals which have not the power of grasping, is a very interesting one in the natural history of animals ; but in this respect there is a wonderful resemblance between common naturalists, or describers of animals, and common portrait painters. They succeed tolerably well in making out a *face*—a surface and the remarkable features which distinguish one individual from another to common observation—but if there is a hand or a foot in the case they make sad work of that ; and just as the face-painter's hand could not work if formed as he represents it, and the foot could not walk, even so the generality of animals could not budge an inch by means of such organs of locomotion as the naturalists in question are pleased to assign to them. It were therefore to be desired that much more minute attention should be paid to the actual structures of animals, and especially to the feet, in which the display of mechanical principle, and perfect adaptation of that principle, are not only more beautiful in themselves, but come nearer to our practical usefulness in mechanical arts than any other parts of the animal fabric. The internal operations of animals—circulation, respiration, digestion, secretion, sensation, and the others, though very wonderful in themselves, and well worthy of being studied, both as portions of general knowledge, and as means of enabling us to economise animal life, and deal kindly with it, have yet little or no application to our common arts, because we have no operation to perform, external of our own bodies, which is of the same kind with these ; and our own internal operations are carried on, not only without our care, but often in spite of our ignorant and ill-directed attempts, which if they were not as futile as they are faulty, would do harm and not good.

The external actions of the animals,—those which we may regard as the uses of the structure of any particular animal in nature, are not only much more in accordance with what we are called upon to do,

but they are really our models ; and many things might be mentioned which men have derived no little celebrity for contriving or inventing, which might have been discovered at once, and in far greater perfection, in the structure of the very best known animal. When we express it in words, it sounds somewhat oddly ; but it is nevertheless true that if the most skilful mechanic is set on horse-back, there is really much more instruction in mechanics to be got from the horse than the man, if the student but knew the way of finding it out.

The feet of mammalia bear in many respects so much general resemblance to our own organs of motion, and prehension, that at least we believe we have some notion of them. The feet of birds are also tolerably open to our scrutiny ; and though our oars and other contrivances for propelling bodies through water, are very imperfect as compared with the swimming apparatus of fishes, yet there is some resemblance. There is curious point in this resemblance, or rather, perhaps, it is a want of resemblance which is worth notice. We propel all our oared craft by a sort of lateral fins, and steer by the rudder as a sort of tail fin ; while the fishes are propelled chiefly by the tail, and, in part at least, guided in their motions by their lateral fins. But to return : the feet of reptiles, and even those curious substitutes which we find in the scales and flexures of the body of those which have no feet, far more nearly resemble those machines which we use in supplement to our hands, than the feet of the higher orders or vertebrated animals. Hence they are far more deserving of our study with a view to the perfection of art ; and when we notice how small and simple an apparatus in these animals suffices for the accomplishment of a great number of purposes, we cannot fail to perceive how much even our best machines must be loaded with unnecessary lumber in which mere complication of parts is often mistaken for that perfection of which it is the very opposite.

In this way animals which are so apparently humble in their sphere of life, and so repulsive to our common feelings as the majority of the gecko family are, may still be made the instruments of useful instruction, if we would but study their forms, and observe how those forms are applied in their modes of life. It is true that geckos are what we call filthy creatures : they crawl in the mud, and search for larvæ and other things, on which they feed in the most loathsome places, so that they often visit the abodes of man, or at least traverse his apartments in no very cleanly plight. They also poison provisions with the tread of their feet, as has been already mentioned ; but for all this they are the workmanship of the same Author as the most elegant race upon earth ; the purposes which they answer are part of the grand scheme of nature's working ; and our wisdom lies, not in avoiding them as odious, but in studying them as one page, though a singular one, of the book of instruction. The greater part of the race have the toes flattened, and with enlarged margins throughout their entire length, and supplied on the under sides with regular scales and folds ; but the number of toes varies ; and on this as well as on other grounds they are conveniently divided into five sub-genera, of which we shall give a mere enumeration, without the details of the species, the greater number of which are merely museum ones, and as such perfectly useless in the study of living nature. These five sub-

genera are named by Cuvier, *Platydictyli*, *Hemidictyli*, *Thecadictyli*, *Ptyodictyli*, and *Spheriodictyli*; and the last admits of some farther sub-division besides that into species.

PLATYDICTYLI, flat toes, have the toes enlarged at the sides for the whole of their length; and furnished on their under surfaces with transverse scales. Some of them have not claws on all the toes, and have the thumbs or inner toes small as compared with the rest. Those which have this structure of the feet are the handsomest of the family; they are beset with tubercles, and ornamented with bright colours. All the known species are natives of the isle of France: some are without pores in the groin; one species is violet on the upper part, and white on the under, with two colours parted by a black line along the flanks; others again are grey with eye-spots all over, brown at the edges, but with white centres; and others have the pores very conspicuous.

A. Facetanus, the wall gecko, is the species with which we are best acquainted. Its general habitat is the basin of the Mediterranean, on all the shores of which sea it is found, though more abundantly in some places than in others. It is the *stellio* of the ancients, though different from the reptiles to which modern naturalists give that name. It is known by different names in different countries; but we believe the most common one has some resemblance in meaning to the English name "toad-lizard." It is found in Egypt, in the states of Barbary, on the east coast of Spain, but not on the west of Spain or Portugal in the same latitudes. It is also found in France, in Italy, in Greece, and throughout the Levant, and is understood to be the kind of reptile which Solomon describes as taking up its abode in the palaces of kings, which does not prove much with regard to the cleanliness of royal dwellings at that period of the world's history. It is an unpleasant animal to look on; its colour is deep dull grey; its head very rough; all the upper part of its body studded over with gnarly tubercles, each of them consisting of three or four smaller ones, placed close together, and apparently running into each other. Its habits are as unpleasant as its appearance; it is a thing of the night, lying concealed while it is light, but crawling out at dusk something after the manner of a toad, searching for flies and other creatures on which it feeds, with its curious cat-like eyes, and probably using its crooked claws to assist in their capture. Deserted houses, neglected corners, mouldering ruins, and all places which in consequence of man's neglect are rank with impurities, and consequently abound in that insect food which it seeks, are the favourite haunts of this creature. And it appears to have borrowed not a few of the gloomy circumstances which are connected with the times and places of its appearance; for it has been very generally set down as one of the most pestilent of creatures, and one which it was a charity even to nature to destroy by every possible means. In this case it has fared much the same as the toad has done, which, like the wall gecko, is no beauty, though it is a very useful scavenger, tending not a little to the destruction of creatures which would taint the air, and thereby contributing more to man's comfort than some of the animals which he cherishes with the fondest admiration.

It gets its name from the facility with which it can ascend the walls of houses, and pass along the roofs and ceilings; and in some parts of the countries which

it inhabits, it is found very useful in clearing the houses of mosquitoes and spiders. There appear to be several varieties of this species, or at all events several species closely allied to it in habits, though they differ a little in some of their external characters. Of these may be mentioned one found in Egypt and Barbary, which has the tubercles entire and round, and more prominent on the flanks than any other part of the body. All these varieties are equally harmless as to attack; but they are all equally offensive in their manners, and it is understood that they all distil from the toes that acrid liquor, which has been described as poisoning provisions, though this property is perhaps stronger in some of the others, and probably this one has the liquor more acrid in the warmer than in the colder places of its abode.

A. gecko, the gecko, is an Indian species, and is the one upon which the name gecko is founded, which is described as being as nearly the sound uttered by the animals. This species has no thumb claws on any of the feet; it is covered with flattened and rounded tubercles on the upper part of the body, the colour of which is reddish marked with round spots of white; the lower part of the tail is covered with square scales, which are imbricated or placed over each other like tiles. It is represented as abounding in all the oriental Archipelago, but is unknown in the western part of the old continent, and in America.

A. vittata is another species inhabiting the same countries; its general colour is brown, with a white stripe down the back, which parts into two branches on the head, and also at the insertion of the tail; and the tail is surrounded with white rings.

A. homalocephala, the margined gecko, is found on the continent of India, and also in the eastern isles; its head and body are bordered with a white membrane, its tail is furnished with lobes of the same, and its feet are webbed. Other species of the same country are mentioned as having the tail without any lobes on the sides; and there are also some of this sub-genus which have claws on all the toes, and some of them are entirely without tubercles.

HEMIDICTYLI. This name does not mean literally that the animals are "half-toed," but simply that the expansion in breadth extends only to half the length. This expansion consists of an oval disc upon each toe, furnished on the under part with two rows of scales, in the form of a chevron, or having an angle in the middle. From the middle of this disc, the second joint of the toe rises, which is very slender, and carries the claw, which however has an articulation, thus forming a sort of third joint. All the known species of this sub-genus are described as having claws on all the fore-toes, and a row of pores near the vent; and the scales on the under side of their tails very much resemble those on the bellies of serpents.

There is one European species of this sub-genus, usually called the warty gecko, which is found in the same countries with the wall gecko. It is of a reddish colour; and the tubercles on the back are small and conical, but with blunted points. There are various species and varieties very much resembling this one in the warm parts of Asia, and some also in America, and the West India islands; but their manners are little known, and not very interesting.

THECADICTYLI, sheath-toed. These have their toes broadened throughout their whole length, and furnished with transverse scales; but they are divided

longitudinally by a deep furrow on the under side, the anterior part of which can entirely conceal the claw, which is the reason they are called sheath-toed. They generally speaking want claws on the inner toes only; and their tails have small scales both on the upper and the under surfaces. As an instance of this division, we may mention the smooth gecko (*A. perfoliatus*), which is found in the West Indian islands, and is there sometimes called the Banana lizard, from its being found lurking in these plants. Its colour is grey mottled with brown; its scales very small on the upper part, and without any tubercles; the tail is long, and furnished with circular folds as in many of the other species, but it is very little; and when once broken off the new one, which grows readily, is very frequently quite different from the original one, and has caused the animal to be described as being more than one species.

PTYODACTYLI, fan-toed, have the points only of the toes widened by marginal expansions, and these have their under surfaces marked with striæ, radiating from a centre like a fan. The middle of each is divided by a longitudinal furrow, in the end of which the claws are placed. There are claws on all the toes, very sharp and crooked. Some have the tail round, and all the toes free, or without any connecting membranes, and these are of course inhabitants of the land only. Others have the tail with margins, and the toes partly webbed, and they are probably, in part at least, aquatic. Of the former, one of the best known species is

A. lobatus, the house gecko. This species is rather smooth in the covering, having the scales and tubercles both very small. It is of a reddish grey colour, with small spots of brown on the upper part. It is a hideous, or, at all events, an ungainly animal in appearance, and the sound which it utters is a hoarse croaking like that of a frog. It is found chiefly on the south-eastern coast of the Mediterranean, and is peculiarly abundant in Syria and Egypt, where it has been long known, and generally disliked. It appears to shun the light of day and the beams of the sun much more than the wall gecko, and the exudation from its feet is far more pestilent than that of that reptile. Indeed, it is not improbable that the greater part of the poisoning quality which has been attributed to the other really belongs to this, and that they have been confounded with each other. The passage of the house gecko over the skin, though its feet produce no laceration, or any mechanical effect whatever, is attended with very severe pain and inflammation, which extend to other parts besides those over which the creature passes. So much is it dreaded on this account in some countries, that in Cairo it is branded with the name of *Abu-burs*, "the father of the leprosy." That it can produce the disease which is thus fathered upon it is not at all likely, though it certainly does occasion much pain and inconvenience. It is probable that this is the one alluded to by Solomon, as taking up its abode in the houses of kings, with the same confidence as the coney (the jerboa) makes its holes in the rock. The minor pests of cold countries like ours, which, where the strictest attention is not paid to cleanliness, are apt to visit us on our couches, and invade our slumbers with a more vexatious species of annoyance than that occasioned by more powerful enemies, are bad enough; and it has been said, that "the man who braves a bomb will yet tremble at a bug." These, however,

are nothing to such a nightly visiter as the house gecko. It is like Caliban's curse; it blisters the people all over, and it is as tenacious of its abode at the present day as it was in the reign of king Solomon. It is true that, in our common translation, the spider is the creature mentioned as the sure tenant of the royal palace; but, as the spider does little harm anywhere, though sometimes accused of it, and usually remains in the middle of her nets, leaving the inhabitants of even the most dingy dwellings in peace, it is more likely that this pestivorous spider-eater was the creature alluded to. There is great difficulty in expelling the house gecko, or even of finding out where it is during the day, but its croaking and its crawling are equally offensive during the night; and when it does come into contact, there is nothing but to submit, and let it run across, for any attempt to seize it with the hand is attended with very painful consequences, as, when alarmed, it sheds its poison more copiously than when left alone.

Nor is the very offensive danger of this loathsome reptile directed against the skin alone, for it prowls about wherever the people deposit their food, and is said to be especially fond of salt meat. It is not the quantity that it eats which is the offensive part of the matter, for its powers of mastication are but limited, but it paddles over everything, leaving the taint of its feet wherever it passes; so that, unless the people have made certain that no house gecko could pass over any provisions that may have remained in the house during the night, they have no security that those provisions shall not be poisoned; and thus, whether the fact is so or not, the uncertainty of this species of feeling is equally bad; because they who live in constant apprehension of any disease, be it what it may, always run a risk of some malady or other arising from their own apprehensions. After all, it is very probable that the ungainly appearance of this animal is the cause of no inconsiderable part of the bad name which it has gotten, because the reports of the mischief arising from it have been chiefly gleaned among a people who are equally remarkable for their ignorance and their superstition.

A. fimbriatus, the fringed gecko. This is a specimen of the other section of this sub-genus. It has a produced margin not only to the sides of the tail, but also along the flanks. It is an inhabitant of the island of Madagascar, and is reported to live in trees, making use of the fringed borders of its body, and the partial webs of its feet, as parachutes in leaping from branch to branch. There are several others which bear a considerable resemblance to this section in some particulars, but differ in others. One of these is the whip-tailed gecko, which inhabits some parts of the Andes, and is understood to be at least partially aquatic. It is of a black colour, and about a foot in length.

SPHERIODACTYLI. This sub-genus consists of a small species, which have the points of the toes formed into little palettes or discs, and the claws always retractile, but without the four-shaped plates which characterise the preceding sub-genus. In some instances the palate seems double, by being cleft in the anterior part. They are principally found in the East Indies and southern Africa.

Others, which are chiefly American species, have the palettes round and undivided. Among them we may mention the spitting banded gecko, which is a small species, prettily marked with transverse bands

of brown, divided from each other by deep red. It is found in several of the West India islands, as are also some other species or varieties about the same size, but differently coloured.

There are several other saurian reptiles which agree with the geckos in most of their characters, but differ from them in not having the toes enlarged, in having claws upon all the toes, and those claws not retractile. Of these we may just mention

Stenodactyli, which have the tail round, the toes striated below, and toothed on the sides. The principal species having these characters is found in Egypt. Its covering is smooth, of a grey colour, spotted with white.

Gymnodactyli, as the name imports, have the toes naked and slender, but the name is usually restricted to such as have the tail round, which are American species. The others, which have so peculiar a character of the tail, that they ought, strictly speaking, perhaps to form a separate genus, are

Phyllurus, leaf-tail. These are inhabitants of New South Wales. Their toes are not enlarged like those of the geckos, but the tail is flattened in the form of a leaf. This organ is so exceedingly brittle, that it is rare to find a specimen having it entire. One species (*P. Cuvieri*), which is found in marshy places in the neighbourhood of Port Jackson, and lives there upon aquatic insects and larvæ, is covered over with pointed tubercles. Its head is elongated, its jaws pointed, its colour on the upper part marbled with brown, and its tail in the form of a fibrous and partially twisted leaf. Another species (*P. Mili*), is smaller than the former, but longer in the legs, blunt in the head, and of a brick-dust colour on the upper part, so that it is not easily distinguished from the ground which it inhabits. The enlarged portion of the tail is near the extremity, and it has a very strange appearance, as if it were an appendage not natural, or apparently of any use to the animal, but added to render its appearance more singular.

GEISSOMERIA (R. Brown). An elegant flowering shrub, introduced from Brazil, belonging to *Didynamia angiospermia*, and to the natural order *Acanthaceæ*. Generic character: calyx bracteate in five unequal parts, the back segment largest; corolla funnel-shaped, limb of two lips, the upper one two-lobed, the lower three-lobed; anthers linear and two-celled; stigma thickish; seed vessel two-celled and four-sided. These plants require a rather rich soil, in which they produce the scarlet flowers in abundance in the stove. They are propagated by cuttings.

GENIPA (Tournefort). A genus of South American fruit trees, belonging to the fifth class and first order of the Linnæan system, and to the natural order *Rubiaceæ*. Generic character: calyx truncate entire; corolla salver-shaped; anthers rather protruding; stigma clubbed; berry four-celled; seeds immersed in pulp. This genus is nearly allied to gardenia, and is treated in the same way. In their native country they yield eatable fruit, but it is not much esteemed.

GENISTA (Linnæus). An extensive genus of evergreen, and deciduous, some of them creeping shrubs, and chiefly European. The flowers are monadelphous, and belong to the natural order, *Leguminosæ*. The greater number of them were known by the common English name broom, so useful to the tidy housewife, to the dyer, and to the brewer, before hops were substituted. See SEEDS.

GENTIANA (Linnæus). A very numerous genus of herbaceous plants, valued for their dwarf-habit and beautiful flowers. They are pentandrous, and give a title to one of the natural orders, viz., *Gentianeæ*. They succeed pretty well in any light, rich soil, or moor earth; some of them require to be kept in pots during winter, that they may have the protection of a frame.

GENTIANEÆ. A natural order, containing twenty-two genera, of which there are a great many species. The gentians, which are the type of the order, are mostly dwarf herbaceous plants, with deep blue, and different shades of orange flowers. They are all pretty, and some of them extremely beautiful, though the most of them are difficult of cultivation. The *Chironias*, *Erythræas*, *Spigelas*, and *Menyanthus*, are all interesting families, and highly regarded by all lovers of plants. Some of the gentians are medicinal, containing an extremely bitter principle, of which the *Villarsias*, *Chirayitas*, and *Walteris*, partake, but in a weaker degree. The root *Spigelia Marylandica* is infused in wine as a febrifuge, and in water as a vermifuge.

Collectively considered, the *Gentianeæ* are hypocrorollous *Primulaceæ*, with opposite, simple, regular flowers; stamens alternate, with the lobes, and the germen superior, and formed of two carpels. The leaves are opposite, rarely compound, sessile, or petiolate, and destitute of stipules. The outward symptoms sometimes observed to follow the administration of what has been supposed to be gentian, have proved to be owing to the *Veratrum album*, which grows in the same districts, having been collected for it in mistake. The base of the famous Portland powder is said to be gentian.

GEODORUM (Jacquin). An elegant flowering genus belonging to the *Orchideæ*. Generic character; sepals spreading, the lower one longest and broadest; labellum hollow and swollen, not jointed at the base; column freely jointed, apex obtuse; masses of pollen in two lobes; glands united. These curious plants are grown in pots of sandy loam and moor earth, and do better in a frame in summer than in the hot-house. They were called *Limodorum* by Roxburgh and other botanists.

GEOLOGY, the science which treats of the structure of our globe; its compound title being derived from two Greek words, implying a Discourse on the Earth. Some modern writers have employed the term "geognosy" as descriptive of this science; but it will be obvious that the *knowledge* of the earth which is here implied, can hardly be satisfactorily conceded to observers who have scarcely penetrated its crust. We prefer, therefore, the less assuming title placed at the head of this article for presenting our account of the labours of those persons who have distinguished themselves in this branch of science, referring our readers to the articles ALLUVIAL, DILUVIAL, STRATA, &c., for a view of the separate details, which would otherwise swell this article to an inordinate length.

It is natural that man should feel a deep interest in the history of the globe on which he is placed, and, indeed, we find that theories for illustrating the structure of the earth, and explaining the changes it has undergone during the lapse of ages, are as old, if not older, than any that are to be found for illustrating any other branch of natural history. But the geologist of the olden time, unfortunately, commenced

his labours by forming a theory, which he afterwards endeavoured to support by twisting nature to agree with his own preconceived views of the organisation of the earth—thus beginning where he should have ended. Now, however, a better directed philosophy teaches us first to investigate the laws of nature and attend to her phenomena; and then, and not till then, seek to combine the facts which actually present themselves into one intelligible whole. So that we first interrogate nature by the light of science, and then from the answers that are obtained, we conclude what must have been the probable chain of events which led to the complete formation of the vast system of wonders that we now behold.

Foreign travel, and an intimate acquaintance with every part of the globe, is commonly considered necessary for the progress of the geological student; such, however, is not the fact, as our own island will furnish all that is necessary for illustrating the fundamental parts of this science. Within a few days' journey of the metropolis may be seen vast temples reared by the hand of nature, and admirably fitted for illustrating some of her geological mysteries, which far excel all the dreams of Arabian fiction. One of these extraordinary natural structures has already been described in the article *BASALT*, where our readers will also find a description of the gigantic causeway, which is supposed at one period to have united Britain to the sister kingdom. But the geological wonders which may be thus traced rising from the bed of the ocean, are equalled, if not surpassed, by the submerged forests that are still traced with their earth-bound vestments in the very heart of our island, and where successive kingdoms of ocean and dry land have been depositing their varied produce of inhabitants for countless ages. Traces of animals and vegetables that are now the exclusive property of another hemisphere, are frequently laid bare in every part of Great Britain; and many that have left no other records of their existence, save those that the labours of the geologist have brought to light. We may take the formation of coal as an example of the extraordinary changes that have gone on in the immediate neighbourhood of the earth's surface. The black, glossy, and compact mass which we call coal, is now pretty generally admitted to be of vegetable origin. It is altogether unlike wood in its general character, and yet, from the abundance of vegetable bodies with which it is associated in some districts, and the gradual transition that is occasionally found between bodies perfectly analogous in their character, there can be but little doubt of the fact. One school of geologists supposing it to be formed by the power of heat, acting on vegetable bodies under great pressure: and another supposing it to be produced by the mere effects of time and chemical change. But we must now examine somewhat in detail the various hypotheses that have been offered by the most eminent writers for explaining and illustrating the structure of the earth.

The first theory of geology which deserves to be noticed is that of the Rev. Dr. Thomas Burnet. This celebrated author was a man of considerable genius, and his work, entitled *Tellurius Theoria Sacra*, though it cannot command the assent of the philosophic mind, will be found to display much learning and a very romantic imagination. According to Dr. Burnet, the earth was first a fluid heterogeneous mass. The heaviest parts descended and formed a

solid body. The waters took their station round this body, and all lighter fluids rose above the water. Thus, between the coat of the air and that of the water, a coat of oily matter was interposed. But as the air was then full of impurities, and contained great quantities of earthy particles, these gradually subsided and rested upon the stratum of oil, and composed a crust of earth mixed with oleaginous matter. This crust was the first habitable part of the world, and was level and uniform, without mountains, seas, or other inequalities. In this state it remained about sixteen centuries, when the heat of the sun, gradually drying the crust, produced at first superficial fissures or cracks; but, in process of time, these fissures became deeper, and increased so much that at last they entirely penetrated the crust. Immediately the whole split in pieces, and fell into the abyss of waters which it had formerly enveloped. This wonderful event, according to Dr. Burnet, was the universal deluge. These masses of indurated earthy matter, in falling into the abyss, carried along with them vast quantities of air, by the force of which they dashed against each other, accumulated, and divided in so irregular a manner, that great cavities, filled with air, were left between them. The waters gradually opened passages into these cavities, and in proportion as the cavities were filled with water, parts of the crust began to discover themselves in the most elevated places. At last the waters appeared nowhere but in those extensive valleys which contained the ocean. Thus, according to this theory, our ocean is a part of the ancient abyss, and the rest of it remains in the internal cavities, with which the sea has still a communication. Islands and rocks are the small fragments, and continents the large masses, of the antediluvian crust; and as the rupture and fall of the mass was sudden and confused, the present surface of the earth is full of corresponding confusion and irregularity.

The following passage from Burnet's work has been highly eulogised by Steele, and certainly it merits praise; it is a funeral oration over the globe: "Let us now," says he, "reflect on the transient glory of the earth; how, by the force of one element breaking loose on the rest, all the beauties of nature, each work of art, and every labour of man, are reduced to nothing; all that once seemed admirable is now obliterated; all that was great and magnificent has vanished; and another form and face of things, plain, simple, and uniform, overspreads the earth. Where are now the empires of the world? where the imperial cities, the pillars, trophies, and monuments of glory? what remains, what impressions or distinctions do you now behold? what is become of Rome, the great city; of eternal Rome, the empress of the world, whose foundations were so deep, whose palaces were so sumptuous? her hour is come; she is wiped from the face of the earth, and buried in everlasting oblivion. But not the cities only, and the works of men's hands, but the hills and mountains and rocks of the earth are melted as wax before the sun, and their place is nowhere found; all have vanished and dropped away, like the snow that rested on their summits."

The "elegant romance" of Burnet was succeeded by the work of his countryman, Mr. Woodward, who in 1695 published "*Essays towards a Natural History of the Earth, and Terrestrial Bodies*." Though he possessed a much better acquaintance with minerals

than his predecessor, and on this account had greatly the advantage of him, he produced a work far less ingenious and interesting. He also proceeded on the supposition of the Mosaic history being literally true, and ascribed the present aspect of our globe to the sole influence of the general deluge. He supposed that all the substances of which the earth is composed were once in a state of solution; that this solution took place at the flood; that on the gradual retiring of the waters, the various substances held in solution, or suspended in them, subsided in distinct strata, according to their specific gravities; and that these are arranged horizontally, one over the other, like the coats of an onion. As this theory was soon found to contradict some of the plainest and most unquestionable facts which the geologists observed, it has had few admirers, and its refutation has been usually considered as obvious and easy.

In 1696, Mr. William Whiston, a man of uncommon acuteness, and of still greater learning, published a "New Theory of the Earth," from its origin to the consummation of all things. He supposed the earth, in the beginning, to be an uninhabitable comet, subject to such extremes of heat and cold as that its matter, being sometimes liquefied and sometimes frozen, was in the form of a chaos, or an abyss surrounded with utter darkness. This chaos was the atmosphere of the comet, composed of heterogeneous materials, having its centre occupied by a globular, hot, solid nucleus, of about 2000 leagues diameter. Such was the condition of the earth before the period described by Moses as the "Creation." On the first day of the creation every material of this rude mass began to be arranged according to its specific gravity. —The heavy fluids sank down, and left to the earthy, watery, and aerial substances the superior regions. Round the solid nucleus is placed the heavy fluid, which descended first, and formed the great abyss, upon which the earth floats as a cork upon the fluid metal mercury. The great abyss is formed of two concentric circles, the interior being the heavy fluid, and the superior water; upon which last the earth or solid crust we inhabit is immediately formed. So that, according to this theorist, the globe is composed of a number of coats or shells, one within the other, of different materials, and of different densities. The air, the lightest substance of all, surrounds the outer coat, and the rays of the sun, making their way through the atmosphere, produced the light which Moses tells us first obeyed the divine command. The hills and valleys are formed by the mass of which they consist, pressing with greater or less weight upon the inner coat of the earth; those parts which are heaviest sinking lowest into the subjacent fluid, and making valleys, and those which are the lightest rising higher, and forming mountains.

Such Mr. Whiston supposed to be the state of our globe before the deluge. Owing to the superior heat, at that time, of the central parts, which have been ever since cooling, the earth was more fruitful and populous anterior to that event than since. The greater vigour of the genial principle was more favourable to animal and vegetable life. But, as all the advantages of plenty and longevity which this circumstance produced were productive only of moral evil, it pleased God to testify his displeasure against sin, by bringing a flood upon a guilty world. The flood was produced, this theorist supposed, in the following manner:—A comet, descending in the plane of the

ecliptic to its perihelion, made a near approach to the earth. The approximation of so large a body raised a strong tide, and produced such a commotion in the abyss concealed under the external crust, that the latter was broken, and the waters, which had been before pent up, broke forth with great violence and were the principal means of producing the deluge. In aid of this, he had recourse to another supposition, which was, that the comet, while it passed so near the earth as to produce these effects by the force of attraction, also involved our globe in its atmosphere for a considerable time, and deposited vast quantities of vapour on its surface, which produced violent and long-continued rains: and, finally, that this vast body of water was removed by a mighty wind, which dried up a large portion, and forced the rest into the abyss from which it had been drawn, leaving only enough to form the ocean and rivers which we now behold.

In the early part of the eighteenth century the celebrated John Hutchinson formed a theory of the earth, which he professed to derive exclusively from Scripture. He supposed that when the earth was first created, the terrestrial solid matter was entirely dissolved in the aqueous, forming a tenacious chaotic mass; that the figure of this mass was spherical, and on the outside of this sphere lay a body of impure air; that within the enclosed sphere of earth or water was an immense cavity, called by Moses the deep; that this internal cavity was filled with mephitic air, similar to that on the outside; that on the creation of light the internal air received elasticity sufficient to force its way through the external covering; that immediately on this the water descended, filled up the void, and left the earth in a form similar to that which it bears at present; that when it pleased God to destroy mankind by a flood, he caused, by his own miraculous agency, such a pressure of the atmosphere on the surface of the earth, that a large portion of it was forced into the internal cavity which it had formerly occupied, and expelled the waters from it with great violence, spreading them over the surface.

Mr. Hutchinson supposed that after the divine purposes were answered by the deluge, the globe, by a process similar to that which first took place, was restored to the form which it now bears.

In 1740, the abbé Moro, an Italian philosopher, published a theory of the earth, which he chiefly derived from the works of Ray, which appeared in the preceding century. He supposed that the surface of the earth, as we now behold it, and especially the mountainous parts, arose originally from the bottom of the ocean. At first, according to him, these mountains contained neither strata of shells, nor any organised fossils; but by means of subterranean conflagrations, earthquakes, and volcanoes, these substances were thrown up in confused heaps, after which they successively subsided according to their different specific gravities, and thereby necessarily disposed themselves in different strata. He also maintained that these submarine eruptions, while they threw up huge and irregular masses of matter, also engulfed marine plants and animals of every kind, which subsided in like manner, and thus formed new mountains, and new beds of stones, sand, metals, and other minerals, intermingled with the remains of vegetable and animal bodies, all which remained under the sea till some new agitation threw them above its surface. He supposed that the waters by which the earth was originally overflowed, sub-

sided by degrees, the dry land appearing first in places adjacent to that where the first man was placed at the creation; that the land extended itself gradually, a considerable time elapsing before the waters had returned to their proper bed, during which time the shell-fish, multiplying in great abundance, were universally distributed by the waters of the sea; and that when the bottom of the sea was raised up by the earthquakes that accompanied the deluge, and formed the mountains, whole beds of such shells were thrown up and distributed as we now behold them.

About the year 1744, M. le Cat, a French philosopher, proposed a theory of the earth, differing from all which had preceded it. According to him, in the beginning, the substance whence metals, stones, earths, and other mineral bodies were ultimately to be formed, was a soft mass, consisting of a species of mud. The earth was a globe, or regular spheroid, and its surface was smooth, and free from hills and valleys. The sun and moon were afterwards created. The fluid which covered the mud became agitated by the flux and reflux to which it was subjected by attraction, and the mud was variously and violently moved. This agitation increasing, a part of the mud became exposed and dried. Continents were thus formed. The materials of the earth being compact and solid, the sea continually excavated its bed; and from the continual retreat of it, and the excavation of the earth, he considered this globe as doomed to be at last so perfectly undermined as to produce a confluence of the sea from hemisphere to hemisphere. Le Cat professed to believe the Sacred Scriptures, and discovered an anxious desire to show that his theory was consistent with them; but it must be obvious that it is as inconsistent with the structure and phenomena of our globe as it is with the Mosaic history.

About the year 1750, appeared the *Telliand* of M. Maillet, a French writer of some note. He taught, that the earth was once covered water, which, by means of strong currents, raised in its bosom all those mountains which different countries bear upon their surface; that this water has been ever since continually diminishing, and will continue to diminish until it shall be quite absorbed; that our globe, being then set on fire, will become a sun, and have various planets moving in its vortex, till its igneous particles being consumed, it will be extinguished; that then it will roll through the immensity of space, without any regular motion, till it is again covered with watery particles, collected from other planets, when it will fix in the vortex of a new sun, and again go through the same course of motions and changes, being supplied with fresh inhabitants, resembling those by which it is tenanted at present; that the earth has probably been undergoing revolutions of this kind from all eternity, and will continue to go through a succession of them without end. This absurd theory, if theory it may be termed—not more hostile to revelation than to sound philosophy, seems to have gained but few adherents, and but little celebrity. But no one has proceeded to the forming of a theory of the earth with the pomp and circumstance of Buffon. It merits attention, not on account of its accordance with present appearances, or as affording plausible solutions of observed phenomena, but from the eloquence with which it is adorned, the extent of information it displays, and the popularity it derived from these sources. He supposes the planets in general to have been struck off from the sun by a

comet; that they consisted of fluid matter, and thence assumed a spherical form; and that by the union of projectile and centripetal forces, they are restrained in their present orbits. After this he supposes that the earth gradually cooled, so that the circumambient vapours were condensed upon its surface, while sulphureous, saline, and other matters penetrated its cracks and fissures, and formed veins of metallic and mineral products. The scorified, or pumice-like surface of the earth, acted on by water, produced clay, mud, and loose soils, and the atmosphere was constituted of subtile effluvia, floating above all the more ponderous materials. Then the sun, and winds, and tides, and the earth's motion, and other causes, became effective in producing new changes. The waters were much elevated in the equatorial regions, and mud, and gravel, and fragments were transported thither from the poles; hence, says Buffon, the highest mountains lie between the tropics, the lowest towards the poles; and hence the infinity of islands which stud the tropical seas. The globe's surface, once even and regular, became now rough and irregular; excavations were formed in one part, and land was elevated in another; and during a period of many ages, the fragments of the original materials, the shells of various fish, and different other exuviae, were ground up by the ocean, and produced calcareous strata, and other low-land depositions. These relics of marine animals we find at such heights above the level of the sea, as to render it more than probable that the ocean once entirely overwhelmed the earth.

Every one who contemplates the earth's surface must trace upon it marks of the most dire and unsparing revolutions, which, from the present order of things, it appears impossible should re-occur, except by the united and continuous agency of the most active powers of destruction. This, says Buffon, arose from the soft state of the former crust of the earth, and those causes, now imbecile and slow in their operation, were then more effectually exerted, and results were obtained in a few years for which centuries would now be insufficient. This amusing theorist next proceeds to contemplate the production of rivers, which he regards as having cut their own way to the ocean, as gradually wearing down the mountainous lands, filling up valleys, and choking their exits into the ocean by the transportation of finely-divided materials. Thus everything is slowly returning to its former state; the mountains will be levelled, the valleys heightened, excavations filled up, and the ocean will again cover the earth.

Buffon's theory was warmly opposed, soon after its publication, by Raspe, a geologist of Germany. He also opposed the theory of Moro, before mentioned, though he considered it as approaching much nearer the truth than the igneous fable of the French naturalist. He insisted, that the opinion of continents and mountains having been thrown up from the bottom of the sea solely by submarine conflagrations and volcanoes, was abundantly refuted by close observation. He contended, likewise, that in veins of sand, marble, chalk, and slate, there are found no indications of a burning soil, but rather of a sediment disposed by the agitation of the sea. Accordingly, he maintained, that the strata, of which the shell or surface of the earth is composed, were originally formed at the bottom of the sea by the constant agitation of the sea, and the continual production of

plants and shells ; that the subterraneous explosions, and earthquakes, breaking through the bottom of the sea, not only formed banks, hills, and submarine mountains of its broken parts, but also frequently raised up such large portions of the beds of the ocean, with its incumbent strata, as to form islands or dry mountains. At certain periods, he supposed, that the presence of so large a body of water would cause it to break through the cavities made by previous eruptions, and at others, the violence of the subterraneous explosions would be so great as to remove mountains from one place to another ; while the heat of the internal fires causing these explosions would be so intense as to melt, calcine, or vitrify, all adjacent substances.

In 1773, Dr. William Worthington published a theory, in which great learning and piety and a considerable share of ingenuity are combined. He maintained that the earth, in its primitive state, was plane and uniform ; and that all mountains, and every thing irregular and rugged on the surface of it, are the result of the curse pronounced on the ground after the Fall of Man ; that the melancholy lapse of our first parents, was immediately followed by earthquakes and every species of convulsion, which produced these dreadful effects on the surface of our earth ; that the antediluvian earth greatly abounded with water, much more than at present, and that the greatest quantity of it was collected round the poles ; that at first the poles of the earth were perpendicular to the plane of its orbit, and at right angles with the plane of the equator ; that the centre of the earth was then the centre of gravity ; that the deluge was produced by the centre of gravity being removed twenty-three degrees and a half nearer to one of the poles, which led to a corresponding deviation of the poles from their former position, and thus threw the great body of water accumulated round them on those places of the earth where little had existed before, and by these means drowned them. This event, he supposed, increased the irregularity of the earth's surface, and produced many of those phenomena, which so plainly establish the reality of a general deluge.

In 1778, Mr. Whitehurst published "An Inquiry into the Original State and Formation of the Earth." This theorist supposed, that not only our globe, but the whole of the planetary system, was once in a state of fluidity, and that the earth acquired its oblate spheroidal form by revolving round its axis in that state. In this fluid state the component parts of the earth were suspended in one general undivided mass, "without form and void." These parts were endued with a variety of principles or laws of elective attraction, though equally and universally governed by the same law of gravitation. They were heterogeneous : and by their attraction progressively formed a habitable world. As the component parts of the chaos successively separated, the sea universally prevailed over the earth ; and this would have continued to be the case had it not been for the sun and the moon, which were coeval with the earth, and by their attractive influence interfered with the regular subsiding of the solid matter which was going on. As the separation of the fluids and solids increased, the latter were moved from place to place, without regularity, and hence the sea became unequally deep. These inequalities daily becoming greater, in process of time dry land was formed, and

divided the sea ; islands gradually appeared, like sand-banks above the water, and at length became firm, dry, and fit for the reception of the animal and vegetable kingdoms. He supposed that mountains and continents were not primary productions of nature, but of a very distant period from the creation ; that they are the effects of subterraneous fires and commotions, and were produced when the strata of the earth had acquired their greatest degrees of firmness and cohesion, and when the testaceous matter had assumed a stony hardness ; and, finally, that the marine shells found in various places, on and below the surface of the earth, were for the most part generated, lived and died, in the places in which they were found ; that they were not brought from distant regions, as some have supposed ; and, consequently, that these beds of shells, &c., were originally the bottom of the ocean.

John Whitehurst, whose geological views we have thus briefly adverted to, was a native of Congleton, in Cheshire. He passed much of his time in Derbyshire, and investigated with considerable ability the stratification of that county. In the course of his inquiries, he has assiduously collected facts, among which his account of the mineral treasures of Derbyshire still retains much value for its accuracy and scientific truth.

Two or three years after the appearance of Mr. Whitehurst's publication, M. de Luc, of Geneva, dissatisfied with the theories which had previously been proposed, offered another, which occupied considerable attention in the scientific world. He supposed that the ocean once covered our continents ; that the bottom of the old ocean was full of mountains, which neither the main waters nor any other cause known to us formed, and which he therefore calls *primordial*. These mountains rose above the surface of the waters, and formed islands. These islands and the ancient continents were fruitful and well-peopled ; and the ancient sea had tides, currents, and tempests like the present ocean. These powers acting upon the soft matters which are known to have formed the bottom of the ancient ocean, produced accumulations of calcareous substances, which, in process of time, became more or less mixed with marine bodies. The rivers, in the meanwhile, carried from the land into the sea the scattered remains of animal and vegetable productions ; the sea itself washed them from its coast into its bosom ; and these materials, transported by currents, became a secondary soil upon its primordial bottom. Fires and elastic fluids, formed by chemical decomposition, made various openings in the bottom of the ocean, whence proceeded torrents of liquid substances and larva ; which gave rise to the volcanic mountains observable on the surface of our continents. The continents which existed in a state of population and fertility, while the sea covered those which we now inhabit, though they did not form a solid mass, but were, properly speaking, vaults, which covered immense caverns, maintained their elevation above the level of the ocean by the strength of their pillars ; which, being of primordial matter, were solid, and stable : but the changes which the subterranean fire produced at the bottom of the ancient sea, opened passages for its waters into the interior of the earth ; the violent excitement produced by this eruption shook the pillars of the primitive earth ; which, sinking into its caverns, the old continents disap-

peared, and their surface descending below the level of the waters, a general inundation ensued. This was the general deluge. The sea now covered all the globe, except the islands of its ancient bottom, which increased in number and magnitude, until the weight of the water, added to that of the superior vaults, crushed the inferior ones, and deepened more and more the new bed of the ocean; so that, at last, by a motion rapid, but not violent, all the waters retired from their former bed, and left our continents dry. Secondary mountains and other irregularities were afterwards produced by volcanic commotions, and maritime currents and convulsions.

Next to the theory of M. de Luc, appeared that of Mr. Milne, which, though it did not engage so much attention, was framed with considerable ingenuity. This gentleman declared himself a warm friend to revelation, and professed to have formed a system in strict conformity with the sacred history. In some respects he agreed with Mr. Whitehurst; in others, he adopted the opinions of M. de Luc; while, with regard to a third class of his doctrines, he claimed to be original. He supposed that the earth, immediately after the fall, and in consequence of the curse pronounced against it, underwent a total change by means of the elementary fire lodged at that time near its centre, and that hence arose the irregularities which now appear in the earth's surface. There are other geological writers who have accumulated many interesting facts, and whose insulated observations are truly curious and valuable; but their general hypotheses are of so chimerical a cast, as rather to resemble eastern allegories than European philosophy; and we are now to proceed to examine the theories promulgated by Professor Werner of Freyburgh, and Dr. Hutton of Edinburgh. Each of these distinguished writers has been ably supported by the proofs, illustrations, and comparative views, of acute and eloquent controversialists. Thus two distinguishing sects have been formed under the appellations of *Wernerians* and *Huttonians*.

The disputes and differences of these contending geologists would now be prematurely noticed. They each profess to proceed, as rigidly as the subject allows, in the path of induction; to reject mere hypothesis, and raise their theories upon accumulated facts; and yet, by a strange perversion of facts, they arrive at conclusions diametrically opposite.

The first principle of the Wernerian theory assumes that our globe was once covered with a sort of chaotic compost, holding either in solution or suspension the various rocks and strata which now present themselves as its exterior crust. From some unexplained cause, this fluid began first to deposit those bodies which it held in chemical solution, and thus a variety of crystallised or primitive rocks were formed. In these we find no organic remains, nor even any rounded pebbles; but in the strata which lie upon the crystalline, or first deposits, shells and fragments occasionally occur. These, therefore, have been termed transition strata, and it is imagined that the peopling of the ocean commenced about this period. The waters upon the earth began more rapidly to subside, and finely divided particles, chiefly resulting from the disintegration of the first formations, were its chief contents; these were deposited upon the transition rocks chiefly in horizontal layers. They abound in organic remains, and are termed by the *Wernerians* *floetz*, or secondary rocks.

It was now conceived that the exposure of the primitive, transition, and secondary rocks, to the action of wind and weather, and to the turbulent state of the remaining ocean, produced inequalities of surface, and that the waters retreated into lowlands and valleys, where a farther deposition took place, constituting clay, gravel, and other *alluvial* formations. There are also certain substances which, instead of being found in regularly alternating layers over the earth, are met with in very limited and occasional patches. Rock salt, coal, basalt, and some other bodies, are of this character, and these Werner has called *subordinate* formations. Lastly, subterraneous fires have sometimes given birth to peculiar, and sometimes very limited products; and these are called *volcanic* rocks. Such is Werner's account of the production of rocks, which he arranges under the terms primitive, transition, secondary, alluvial, subordinate, and volcanic formations.

A number of delicate distinctions and accurate minutiae of description attend this theory, which we cannot notice in this brief view, and which do not affect the general conclusions. If we examine the stratification of our globe, we shall doubtless find that certain substances do occur in a certain order of arrangement, and that they appear to have been successively deposited, one upon the other, in the manner Werner would have us believe. He, therefore, and his disciples, have perhaps given a satisfactory account of their own country; but when we examine other parts of the earth's surface, so many incongruities are discovered, and so much is at variance with their leading doctrines, that we are obliged to give them up in favour of views more generally applicable.

Dr. Hutton gives a very different account of the present order of things. Looking upon the face of nature, he observes everything in a state of decay; and as she has obviously provided for the regeneration of animal and vegetable tribes, so the philosophic mind will descry, in this apparent destruction of the earth's surface, the real source of its renovation. The lofty mountains, exposed to the action of the varying temperature of the atmosphere, and the waters of the clouds, are, by slow degrees, suffering constant diminution; their fragments are dislodged; masses are rolled into the valley, or carried by the rushing torrents into rivers, and thence transported to the sea. The lower and softer rocks are undergoing similar, but more rapid, destruction. The result of all this must be the accumulation of new matter in the ocean, which will be deposited in horizontal layers. Looking at the transition rocks of Werner, he perceives that, though not strictly crystalline, they appear made up of finely-divided matter, more or less indurated, and sometimes very hard in texture, and of a vitreous fracture; and that this hardening is most perceptible when in contact with the primitive or inferior rock, which often pervades them in veins, or appears to have broken up or luxated the superincumbent masses. According, then, to Dr. Hutton, the transition and secondary rocks of Werner were deposited at the bottom of the ocean, in consequence of operations similar to those which are now active, and the primary rocks were formed beneath them by the action of subterranean fires; their crystalline texture, their hardness, their shape, and fracture, and the alterations they have produced upon their neighbours, are the proofs of the correctness of these views. It is by the action of subterraneous

fire, then, that rocks have been elevated, that strata have been hardened, and that those strata have resulted, which an examination of the earth's surface unfolds. The production of soils, and of alluvial land, is considered as dependent upon causes the same as those referred to in the other theory.

It will be observed that Hutton refers to fire as well as water for the production of our present rocks; the former consolidating, hardening, and elevating; the latter collecting and depositing the strata.

We have thus brought together a brief outline of the principal systems, or rather hypotheses, that have been employed to illustrate the history of our earth; but very considerable light has been thrown on the changes which it has undergone by those geologists who have peculiarly directed their attention to the remains of a former world that are so richly embedded in its surface. This part of the subject has, however, been fully discussed in the article FOSSIL REMAINS, to which we must refer our readers, as well as to the various articles relating to geology as they occur in their alphabetical order. To those who wish for an intimate acquaintance with all the facts bearing on this subject, we would recommend a study of the voluminous but interesting "Transactions of the Geological Society," which, added to the printed labours of Phillips, Conybeare, Ure, Buckland, Boué, Lyell, and Cuvier, contain the most extraordinary collection of facts that has yet been brought together in any branch of natural history.

GEOMETRIDÆ (Stephens). A very extensive family of lepidopterous, nocturnal, or rather semi-nocturnal, insects, known to collectors by the name of slender-bodied moth, by which term they are well distinguished from the *Bombycidæ* (feathered full bodies) and *Noctuidæ* (thread-horned full bodies). From the other families of moths, *Tortricidæ*, *Teneidæ*, &c., they are distinguished by their larger size. Mr. Stephens has described more than three hundred British species belonging to this family, divided into upwards of sixty genera. The family is further characterised by the antennæ of the males being generally feathered, and those of the females simple; the palpi are mostly short and three-jointed, and the spiral tongue varies considerably in length, sometimes, indeed, being obsolete; the legs are long and slender, the posterior tibiæ being furnished with two pairs of spurs, one being placed in the centre, and the other at the extremity; the wings are of a large size, generally horizontally extended, and much variegated with markings of various colours, whence these insects are amongst the most beautiful of the *Lepidoptera*. The name of the family is derived from the Greek words *ge*, the earth, and *meter*, to measure, and is given to these insects on account of the peculiar motions of the caterpillars, which are ordinarily termed "loopers" by collectors, and which, when creeping along, somewhat resemble a pair of compasses alternately opened and shut. An example of this kind of caterpillar has been figured in the article ABRAHAS. When unemployed in walking, they stretch themselves out in a straight line, adhering to the twigs by their hind legs only, and, in many instances, so completely resembling bits of sticks, as to deceive the beholder. A figure of the caterpillar of the swallow-tail moth (*Ourapteryx sambucaria*) is given in our article CATERPILLAR.

Some of these caterpillars also possess the power, when alarmed, of throwing themselves from the

leaves or twigs, having first attached thereto the end of a silken thread, by means of which they suspend themselves in the air; this thread, which proceeds from the mouth, is lengthened or shortened at will; and it is by means of this thread that the caterpillar descends from the tree to the earth to undergo its chrysalis state; it also employs the same thread to remount to its original situation when the danger is passed; this motion being effected by the insect seizing hold of the thread with its intermediate legs, between which it accumulates a greater or less mass, in proportion as it advances. Some species form for themselves slight cocoons of silk under ground, others amongst the leaves, and some are naked in the chrysalis state, and are suspended only by the tail. In their perfect state these insects offer but few particulars worthy of remark. Unlike the majority of the moths, some of these slender bodies fly during the afternoon. They abound in woods and hedges, and their flight is much lighter than that of the *Bombycidæ* or *Noctuidæ*. The males of some species present the curious character of being apparently six-winged, the lower wings being provided with a large flattened oval appendage, somewhat like a miniature wing. These form the genus *Lobophora* of Curtis. In several other of the species the females are destitute of wings, as in the *Phalæna*, *brumata*, *defoliaria*, *pedaria*, &c. The first of these species, as the name implies, is found in the winter flying, during the month of December, about the leafless whitethorn hedges, in search of its mate. In the Règne Animal Latreille united these insects in a single "sous-genre." Mr. Curtis has, however, divided them into two families, *Phalænidæ* and *Geometridæ*, in which the antennæ of the males are either feathered or merely ciliated, or even simple; but this step, as Mr. Stephens observes, is "evidently unnatural," since some genera have the male antennæ simple, though closely allied to insects having strongly pectinated antennæ, whilst some females have pectinated antennæ, although placed with others in which they are simple, and in which some of the males have them scarcely pectinated.

With the exception of the variations of structure and peculiarities of habit above noticed, which, of course, constitute the leading characters of the sectional and generic divisions established in this family, it must be evident that in so large an assemblage of objects possessing so many characters in common, the distinguishing marks must be of a comparatively trivial nature; hence, it will not be necessary for us, in a work of this nature, to indicate the names of the numerous generic divisions introduced into the family, and still less to describe them, and shall, therefore, only notice that the genus *Geometra*, as now restricted, comprises a beautiful group of moths, called "thorns," in which the wings are all angulated, and the male antennæ pectinated; that one of the most beautiful, although one of the commonest species is the *Abraxas grossulariata*, figured in our first volume; that another beautiful species, being the largest of the family, is the swallow-tail moth, above noticed, in which the hind wings are furnished with short tails, and that there is a very extensive and pretty group in the family, known by collectors under the name of the carpet moths, in which the wings are of a white or pale colour, with numerous undulating bands of slate-grey and other colours.

GEONOMA (Willdenow). A genus of orna-

mental palms found in South America. They have been introduced into our stove collections, and are found to grow best in sandy loam, placed in strong heat.

GEORGINA (Willdenow) is the well known DAHLIA, which see. The latter name was given by Cavanilles, but changed to the original name by Willdenow; but it does not appear to be generally adopted, as Dahlia still prevails among modern writers.

GEOTRUPIDÆ (Mac Leay). A rather extensive family of coleopterous insects, belonging to the section *Pentamera*, and sub-section *Lamellicornes*, forming part of the vast genus *Scarabæus* of Linnæus, and distinguished by the following characters:—The body is generally very convex, and orbicular or suborbicular; the thorax broader than long, and often armed, as well as the head, with horns; in the males the scutellum is distinct; the anterior tarsi fully developed; the legs inserted at equal distances apart; the jaws exposed, horny and curved; the antennæ mostly eleven-jointed.

To this family belong the genera *Bolbocerus*, *Typhæus*, *Geotrupes*, *Lethrus*, *Elephastornus*, *Ichodæus*, *Athyreus*, and several other exotic genera. Of these the three first are British, but the third alone will claim any particular notice in a work like the present.

The typical genus, *Geotrupes* (Latreille), derives its names from two Greek words, signifying burrowing in the earth, a habit possessed by the insects in an especial manner, for which purpose their fore-legs are endowed with very great muscular power; and and as they are broad and externally notched, they are well adapted for the mode of life of the insects. The body in this genus is, moreover, highly polished and rounded, so as to present but slight obstacles in the act of burrowing. The antennæ are eleven-jointed, the second joint being shorter than the third; the basal joint of the tarsi is also very short; the mandibles are exposed, and toothed at the tips; the last joint of the palpi is scarcely larger than the preceding, and the thorax is not armed with horns. The type of this genus is the well-known insect which is to be constantly observed flying about at dusk, especially in the neighbourhood of newly fallen dung, and striking against every thing which may happen to be in its way, whence we have obtained the saying, “as blind as a beetle.” This insect is the *Scarabæus stercorarius* of Linnæus; it is of a shining black colour, and of an oblong oval form, but the under-surface exhibits a very splendid mixture of varying purple, green and steely blue; the elytra are deeply striated, and the striæ are ornamented with small impressed dots. The length of the insect varies from two-thirds to an entire inch.

These insects seem to prefer still dull evenings for their flight, at which time the humming noise which they make is very considerable. Probably at such periods the effluvium arising from the stercoraceous matters which they inhabit, is more widely disseminated through the atmosphere, so as to cause the insects to congregate together more numerously. They dig holes to a considerable depth in the ground under the dung, around which they have been flying, and of which they bury a portion, depositing an egg in the midst of it, which serves for the food of the larvæ when hatched. Thus do they take their share, as well as by feeding upon such matters themselves, in the general economy of nature, “not only dispersing the dung, but actually burying it at the roots of ad-

jacent plants, and, by these means, contributing considerably to the fertility of our pastures, supplying the constant waste by an annual conveyance of fresh dung, laid at the very root, by their canals; also affording a convenient passage for a portion of it, when dissolved, to be carried thither by the rain.”

Our great dramatic bard has mentioned these insects more than once, and, in so doing, has proved his knowledge of the habits of the various objects of nature to have been as extensive as of the workings of the mind of man—and indeed we are happy in taking as early an opportunity as possible of vindicating our poet from those who would tell us that he always sacrificed nature to poetic effect. Such, unquestionably, was not the case, and wheresoever he speaks, not only of animals, but even of flowers, it is always with a perfect knowledge of the habits of the one, or of the time of flowering, &c., of the other. We trust soon to have the pleasure of seeing the talents of Shakspeare, in this respect, fully established by the publication of a series of essays from the pen of a distinguished naturalist, and we scarcely know any subject so capable of being made not only interesting, but highly instructive.

Macbeth, on the evening of the murder of Banquo, by murderers whom he had hired for that purpose says—

—— “Ere the bat hath flown
His cloistered flight; ere to black Hecate’s summons
The shard-borne beetle, with his drowsy hum,
Hath rung night’s yawning peal, there shall be done
A deed of dreadful note.”

Now, every one admits that the *shard-borne beetle* is the *Geotrupes stercorarius*, and not the *Melolontha vulgaris*; but commentators are not equally agreed as to the meaning of the term shard-borne, and as it involves the natural history of the animal, we shall not hesitate to enter into a little detail upon the subject; in fact there is scarcely a single passage in Shakspeare (except, perhaps, the “Aroint thee witch,” in the same play) which has been more commented upon than the above, not only by the commentators, but also by naturalists, amongst whom we find Spence, Mac Leay, Heineker, Bennet, &c. Now, the word shard is rendered by some authors a broken piece of tile or earthen vessel, and so Shakspeare himself has used it in *Hamlet*, thus, “Shards, flints, and pebbles should be thrown on her:” and, by an easy process, the same word would be used for scales, as, where Gower speaks of a dragon “whose sharden shynen as the sonne;” and thus the scales or elytra of the beetle would be termed its shards; but Tollet, who opposes Malone, Steevens, Nares, and others, says “the sharded beetle means the beetle lodged in dung,” and he cites various passages in support of such assertion; thus Bacon says “Turf and peat and cow-shards are cheap fuel and last long;” and in Dryden’s *Hind and Panther*, “Such souls as shards produce, such beetle things;” and in “A true report of Capteine Frobisher, his last voyage, &c. to the Orkneys,” we find “They are destitute of wood, their fire is turffes and cow-sharden.” Moreover, Mr. Mac Leay states that shard is the common name for cow-dung in the north; Mr. Spence, consequently, supposes that Shakspeare originally wrote *sharn-born*. And, indeed, we find in Merrett’s rare *Penax*, p. 201, the description of this very beetle, “*Scarabæus stercorarius vel fimetarius*, a dung beetle or *shard-bug*.” Hence the conclusion which these authors draw is, that Shakspeare alluded not to the

scaly appendages of the beetle, but to its residence in dung, and, consequently, that we should read it the shard, or dung-born beetle, instead of the shard or elytra-borne beetle.

But Shakspeare has elsewhere spoken of these beetles with the same epithet. In *Cymbeline*, Act III., scene 3, Belarius comes out of his cave in a rock, and says—

“ We house i’ the rock —
And often to our comfort shall we find
The sharded beetle in a safer hold
Than is the full-winged eagle.”

Now, singularly enough, this passage is capable of being read with a similar double signification, both with reference to a covering by scales or elytra, and a lodging in dung; thus the interpretation given to this passage by Steevens, Malone, Holt, White, and Arehdeacon Nares, is, the beetle covered by elytra is safer, as opposed to the full wings of the eagle; whilst by Tollet (who supports the interpretation of the word shard into dung), the humble earthly abode beneath dung of the beetle, is opposed to the lofty eyry of the eagle.

With all due deference, however, to these learned commentators and naturalists, we are inclined to believe that in their attempts to illustrate their author, they have laboured to show the extent of their own researches, rather than studied the passages in which these words appear, and endeavoured, by such study, to trace the application of such passages. With this object in view, let us therefore now examine the words of our author, whose wonderful knowledge of the English language was such, that he would neither make use of useless words, nor yet employ right words in wrong places.

The murder of Banquo was perpetrated previous to the evening feast. Macbeth, therefore, alludes to the period when it should take place, by speaking of the flight of the bat, and naturally connecting it with another twilight-flying animal, adds the passage in question, which we interpret, “The beetle flying with raised scales, and making a drowsy hum during its flight, tolls a natural curfew bell.” If we were to adopt the other interpretation, we should find nothing to indicate the *flight* of the beetle. Whilst, on the other hand, the word *shard born*, i. e. born in dung, would be an useless surplusage.

In like manner, in the other passage we find Shakspeare’s knowledge of the habits of this insect still more perfect, since, instead of regarding it, with Steevens, &c., as applying only to the safety of the beetle, in consequence of its scaly covering, as contrasted with the extended wings of the eagle, or with Tollet, as applying only to the underground abode of the beetle, we read the passage, having at the same time regard to the residence of Belarius in a cave, thus, “The beetle, with its wings folded up beneath its scales, is safer in its burrow in the ground than is the full-winged eagle.” Is it possible for a finer simile to be employed? Belarius himself, a banished nobleman, living as an obscure peasant, deprived of every wordly greatness, comparing himself with the monarch who had banished him. The one leading a life of quietness in a cave, the other of constant turmoil and alarm on a throne. But there is still another passage, which we shall quote. In *Antony and Cleopatra*, Act III., scene 2, Agrippa, speaking of the love of Lepidus for Cæsar and Antony, says, “Both he loves;” to which Enobarbus adds, “They are his shards, and he their

beetle;” i. e., their love is so reciprocal that they may be said to be as much a part of the same body as are the elytra upon the back of a beetle. Any other interpretation of this passage, in favour of the employment of the word dung for shard, would be ridiculous



The shard borne beetle.

Mr. Stephens has described ten species of this genus as inhabitants of this country, but it is possible that a few of them may be varieties of the others.

GERANIACEÆ. This natural order is divided into two tribes, and contains five genera and above 300 hundred species. They are innocuous plants, in general slightly acid, and sometimes also astringent; hence a few have been used as astringents and vulneraries. They are also more or less fragrant, secreting resins and essential oils: in some the secretions are so abundant that, in the *Sarcocaulon L'Heretieri*, the stems burn like torches, and yield a most agreeable perfume during their combustion. The roots of *G. maculatum* are used, when boiled in milk, as a remedy for the diarrhœa in children; and at Philadelphia it is in great repute. *Erodium cicutarium* and *moschatum* are also sometimes employed as aromatic bitters, and *Pelargonium cucullatum* as an emollient; from *P. odoratissimum* a fragrant essential oil has been distilled, said to resemble the ottar of rose, or at least to be as agreeable as it, and the under-ground tubercles of *P. hirsutum* are esculent, and are prized as food by the Arabs; but, notwithstanding their several domestic uses, the *Geraniaceæ* are chiefly esteemed for the beauty of their flowers, being deservedly great favourites, and some of the most fragrant and admired denizens of our greenhouses and gardens.

GERRIS (Latreille). A genus of hemipterous insects, belonging to the section *Geocoris*, and family *Hydrometridæ*. The body is long and narrow, the antennæ half the length of the body, and four-jointed, the rostrum four-jointed, the second pair of legs inserted at a considerable distance from the anterior pair, and very long. This genus, although introduced into the section *Geocoris*, or land-bugs, owing to the structure of the antennæ, is aquatic in its habits; from the true *Hydrocorisa*, or water-bugs (*Nepa*, &c.), its long antennæ, and the want of ciliated hairs to the legs, as well as its inability to live *under* water, sufficiently distinguish it. By every one who has had an “eye to nature” these insects must have been observed, gliding along the surface of water with great agility, by oft-repeated strokes of the long slender legs, turning in all directions, and seizing upon every smaller insect which may happen to fall in their way. The form of the body resembles that of a London wherry; and on examining more minutely the structure of the insect we shall find it admirably adapted for the per-

formance of its motions, and the consequent support of its habits. The under surface of the body is thickly covered with a fine layer of silvery hairs, which renders it impervious to the action of the water; but it is requisite that, for an insect residing upon the surface of the water, and feeding only upon such stray morsels as may happen to be floating there, that quick motion, and a power of suddenly turning in various directions, should be given to it. In the wherry we find these motions effected by long oars, acted upon from the sides of the boat and a rudder at its stern; and this is the case with the insects in question. Mr. Curtis says, "These insects, by rowing with their *posterior* feet, glide over the water," but this is incorrect. It is the *middle* legs, placed at the sides of the body in the centre, which perform the office of oars, being for this purpose much longer than the other legs, the hind pair acting at the same time conjointly as rudders. The fore legs are short, and formed for seizing the prey, which is immediately brought to the mouth.

The type of the genus is the *Cimex lacustris* of Linnæus. There are several British species, but their characters are not sufficiently elucidated, since we are convinced that the supposed apterous species upon certain occasions acquire wings, as is the case with the other genera of the family.

GERVILIA (DeFrance). This genus contains several species of fossil shells, found in the department of La Manche: the animal and, of course, all recent species are altogether unknown: it is classed immediately preceding the genus AVICULA, which see for its classification.

GESNERIA (Linnæus). Under-shrubs and tuberous-rooted herbs, mostly natives of the West Indies; class and order *Didynamia Angiospermia* and natural order *Gesneriaceæ*. Generic character; calyx attached to the germen, five-cleft; corolla tubular, full at the upper part, limb nearly equally divided, often two-lipped, spreading or reflexed, upper lip two, lower one three-lobed; stamens have ovate, two-celled anthers; style with a two-lobed stigma; capsule of one cell, containing minute chaffy seeds. These plants require a light rich soil, and may be propagated by cuttings.

GESNERIÆ. A small natural order of tropical herbs with large downy leaves, and bearing purple or scarlet flowers. The inflorescence is spicate, branching or paniculate, seldom solitary; the flowers irregular; the calyx is free, half adhering or joined to the germen; the corolla is perigynous or hypogynous, irregularly five-lobed, somewhat two-lipped, the upper one two-lobed, the lower one three-lobed; the disc is annular, perigynous and studded with glands; the stamens, four in number and didynamous, inserted in the tube of the corolla; filaments free; anthers two-celled; the germen is formed of two connate carpels, containing many seeds; style one, bearing a headed stigma. The *Gesneriæ* are very ornamental plants, but their economical value is little; some have been used as dyes, and the fleshy fruits of others are eatable: they are sweetish and mucilaginous, but not much prized.

GEUM (Linnæus). A genus of hardy herbaceous perennials, chiefly natives of the northern parts of the world: two of them are common British plants, where they are called *Avens*. They belong to the natural order *Rosaceæ*: a species of saxifrage is also called *geum*.

GIANT FENNEL, is the *Ferula communis* of Linnæus; one of genus of large herbaceous plants belonging to *Umbelliferæ*.

GILLIESIÆ. A natural order, allied to the *Asphodeleæ*, but separated by Dr. Lindley. The order contains only one or two genera, viz., *Gilliesia*, and *Mersia*, both Chilian plants, with small inconspicuous, irregular liliaceous flowers, grass-like leaves, and tunicated bulbs, by which they differ from the *Asphodeleæ*. They are neither ornamental nor useful, although, from their structure, curiously interesting plants.

GILLYFLOWER, is the *Mathiola incana* of R. Brown. This, under the name of stock-gillyflower, is one of the oldest favourites of the florist. Under cultivation the flowers become double, and vary into many different colours: they are at the same time delightfully fragrant. Some of the species are annuals, and other biennial. They belong to the natural order *Cruciferæ*.

GINGER, is the *Zingiber officinale* of Roscoe. A plant which yields a useful spice and condiment. The tuberous root is the useful part, obtained by cultivating it in fields on a large scale in the East Indies, and forms, at present, an important article of commerce from both Indies. It belongs to *Scitamineæ*.

GINSENG, is the *Panax quinquefolia* of Linnæus. As a drug, it has been from time immemorial extolled in China as a universal panacea or remedy for all ills. Pere Jartroux says that the most celebrated physicians of China have written volumes on the *Gin-seng*, which they affirm to be able to ward off or remove fatigue, to invigorate the enfeebled frame, to restore the exhausted animal powers, to make old people young, and, in a word, to render man immortal—"if any thing on earth can do so." Hence the name *Gin-seng* signifies, "the dose for immortality." Osbeck says the Chinese take it every night and morning in their tea or soup, and that he never looked into apothecaries' shops but they were always selling *gin-seng*. The plant is a native of North America, as well as of Chinese Tartary; it grows chiefly in desert places, difficult of access, or at least the venders tell strange tales of dangers encountered by those who collect the root, perhaps with the design of enhancing its value; and it has been known to cost its weight in gold.

GIRAFFE (*Camelopardalis*). A very singular genus of ruminating mammalia, one of the most singular indeed of the whole class, and an inhabitant of very peculiar pastures. The history of this animal, in different ages of the world, is as checkered as its appearance is peculiar. That it was known to the ancient Romans, and brought among other African animals to Rome, there is little doubt; and it was from the Romans that it received the generic name which it still retains, though in common language it is now known by the less exceptionable one of giraffe. Camelopard is of course compounded of the two words camel and panther, with neither of which this animal has a very close analogy. It no doubt belongs to the same order with the camel, is found in the same parts of the world, and feeds on substances not very different; but its general aspect is very different from that of the camel, and to those who have seen the more common animal and not this one, the association of the idea of a camel with the name would give a very erroneous impression. It is worse with

the other part of the name, *pard*, which means leopard or panther, or in fact any of the larger spotted animals of the cat tribe, with which the giraffe has nothing in common, farther than it is also a spotted animal.

The first account which we have of the giraffe being publicly exhibited to the Romans, was by Cæsar at the Circensian games; but from the representations of it that remain in ancient mosaics, especially in the Prænestine pavement, in which it is represented both browsing the branches over it and in grazing the more humble vegetation under, there is reason to believe that it had not been rare in the subsequent period of Roman history. The Romans obtained their wild animals for exhibition chiefly from northern Africa, where no giraffes are now to be found; and this would lead us to conclude that northern Africa has undergone considerable changes since that period, and that, as the desert has encroached upon what was formerly the most fertile possession of man in Egypt, so it has, in like manner, encroached on the pastures of wild animals all round, until many of those which were common over great part of the African continent at one period of history, are now confined within comparatively narrow bounds.

The giraffe is mentioned by several ancient writers, but the earliest correct account of it which has come down to us, is that given by Heliodorus the Greek bishop of Sicca, in his *Æthiopica*: "The ambassadors of the Axæomitæ (the Abyssinians)," says the bishop, "brought presents to Hydaspes, and, among other things, there was an animal of a strange and wonderful species, about the size of a camel, which had its skin marked with florid spots; the hinder parts from the loins were low, like those of the lion, but the shoulders, fore-feet, and breast, were elevated above proportion to the other parts; the neck was small, and lengthened out from its large body like that of a swan; the head in form resembled a camel's, but was in size about twice that of a Lybian ostrich, and it rolled its eyes, which had a film over them, very frightfully. It differed in gait from every other land or water animal, and waddled in a remarkable manner; each leg did not move alternately, but those on the right side moved together, independently of the other, and those on the left in the same manner, [so that each side was alternately elevated. This animal was so tractable as to be led by a small string fastened to the head, and the keeper could conduct it wherever he pleased, as if with the strongest chain. When it appeared it struck the whole multitude with terror, and it took its name from the principal parts of its body, being called by the people, extempore, *camelopardalis*."

The word giraffe, which has been adopted as the modern name, is understood to be African, though it is said to be derived from an Arabian corruption of the original term. It is of little consequence, however, by what name this animal may be called; for there is no danger of confounding either its appearance or its characters with those of any other known animals.

It stands alone; and though it is decidedly a ruminating animal, and one of the most gentle of the whole order, though timid and exceedingly difficult to capture when in the wild state, it has little in common with any other. The length of the neck, the callous appendages on the knees and the sternum, give it some resemblance to the camel; and the head also has some slight analogy to the head of that ani-

mal; but here the resemblance ends. The body, which is very handsome, is peculiar in its form; and the legs, though they exceed in length those of every known animal, partake of the joint characters of those of the horse and the antelope; while the tail is not unlike that of the ox tribe. The feet agree with those of the horse, in being without the spurious hoofs which mark most of the ruminant animals, and in the peculiar enlargement of the base; but the hoofs are divided, and thus the foot altogether is different from that of the horse, and also of the camel, which has the foot of a very different texture, and is not adapted for the same fleet motion as this animal. Some idea of the form of the animal, and its altitude while browsing the young branches of its favourite acacia, and which it seizes by its prehensile tongue, may be obtained by inspecting the plate GIRAFFE, where the animal is very faithfully and forcibly represented in two attitudes, and the artist has succeeded in delineating the mild expression of the animal as well as the form.

Many attempts have been made to trace resemblances, or, as they are called, affinities, between the giraffe and various other ruminating animals; but it does not appear that any of them have been tolerably successful, for while the likeness has been apparently made out in one part, there has always been so palpable a contradiction in some other part, as to render the whole of very little value. The characters of the genus, or rather of the group, or sub-order,—for though there is but one known species, and we have no evidence that there ever was more than this one, it requires this distinction,—are the head in both sexes furnished with a species of horns, which consist of prominences of the frontal bone, which rise parallel to each other to the height of about six inches in the male, but rather less in the female. They contain no true horn in their substance, but are merely a cellular enlargement of the bone, of nearly equal thickness throughout the whole length, and with the upper extremity formed like a sort of cushion, and beset with a sort of bristly hairs. Those appendages to the head are of course never shed, they are not at any time bare of skin, nor does the animal use them for any known purpose either of defence or in its more peaceable economy. These curious horns, or rather appendages, for they contain no horn in substance, unless the stiff hairs on their extremities are to be considered as such, are not absolutely continuations of the frontal bones, for in the young animal they are united by a distinct suture; and there is a third tubercle of bone, much broader but not near so high as the others, articulated on the middle of the frontal, intermediate between them. The only known species is,

THE GIRAFFE (*Camelopardalis girafa*). This, when full grown, is by much the tallest of animals if measured from the hoofs of the fore feet to the top of the head. From fifteen to eighteen feet is mentioned as being the height of the majority, though specimens have been seen as high as twenty feet. A considerable portion of this height arises from the length of the neck, though the shoulder is also high, much higher in proportion than the rump. Some have said that much of the apparent height of this part of the body is owing to the great length of the spinous processes of the scapular vertebræ; but though these processes upon the anterior part of the spine are long, and thus afford firm points of insertion to the muscles of the shoulder, yet the great height is in

the legs and the neck, which answer to each other. Behind the animal is not so high, and in that part it appears lower than it really is, as the hind legs are partially bent when the animal is browsing at the full stretch of its neck. On the other hand, when it feeds on the ground, which it can do much more easily than is generally supposed, it has to diminish the height forwards by setting the fore feet apart from each other, as is done by the young of the horse in their first attempts to graze.

Altogether the appearance of these animals, though peculiar, is very graceful. The body is short, compact, and well filled up and rounded. The limbs are clean, but at the same time strong and muscular, and the form of the neck and its union with the head are very symmetrical. The head is light and airy in appearance, and has not the least appearance of being a burden on the neck, as is the case with some other ruminants. The ears, which are long and have a good deal of motion, are handsomely formed. The eyes are large and clear; and it is placed in a peculiar manner, occupying so prominent a place on the sides of the head that they command perhaps more of the horizon than those of any other animal. In this respect they bear some resemblance to the eyes of the hare; and they appear to answer a purpose something similar—that of watching against danger from behind, which is the chief danger to which this fleet and strong but inoffensive and gentle animal is exposed.

The colours of the giraffe are disposed in a very pleasing manner. The ground colour is whitish, but with a tinge of warm cream colour, and the spots, which are brown and nearly square in shape, give it the appearance of being cross-barred with the paler colour. When young the sexes resemble each other in their colours; but as they advance, the spots on the male become of a dark brown, while those on the female retain more of their original rust-coloured tint. Both are, however, subject to some varieties of colour, perhaps in proportion as they are differently exposed to the action of the sun.

The hair on the body is short, and lies flat and smooth on the skin; but the neck and upper part of the back are furnished with a short mane. At each side of the commencement of this mane on the occiput, there is a bony tubercle on the skull, which tubercles appear as the rudiments of a second pair of horns; so that if we include the flat one in front, there are bases for five horns on the head of the giraffe, though there is not a true horn on any of them. The tail is strong, reaching beyond the heels, sort haired for the greater part of its length, but furnished with a handsome brush of strong hairs at the tip. The true hoofs are firm and strong, and of a black colour, and, as we have already observed, there are no false hoofs. Though the animal is by no means rare in its native localities, it is so shy in a state of nature, and so well formed for getting speedily out of sight, that its economy is but little understood. The common report is, however, that the female goes twelve months, and never has more than one at a birth.

Giraffes, at least as well ascertained, are confined to Africa, though some of the authorities mention them as also occurring in Asia, but in what particular place of Asia is not stated; it is not impossible, however, that they may exist in some unexplored parts of the warm regions of that quarter of the world,

which resemble in climate, seasons, and productions, their African haunts. The pertinacity with which it was long maintained that no lion existed in any part of India, and the discovery of several of these animals after the country became a little better explored, should teach us to pause before we positively decide what tropical production, whether animal or vegetable, does not exist in so extensive and so varied a country as India.

At present, however, we know the giraffe only as an African animal; and there chiefly as an animal of the southern parts, at least to the countries to the southward of the desert. It is not found on the coast of Guinea, where there are more frequent rains and greater fertility but a less healthy climate, than far into the interior, and nearer the Great Desert; nor does it appear that the giraffe is any where found on low and marshy grounds. Indeed the form of its feet, and its structure taken altogether, are ill adapted for such places; and any one who examines even a tolerably well executed figure would at once decide that the giraffe inhabits dry pastures, and breeds upon firm ground. Its numbers in central Africa, south of the desert and south-west of Abyssinia, have not been very clearly ascertained; but it certainly does range in latitudes from about that parallel southward to the confines of the Cape Territory, where it is not unfrequently met with in the woods near Orange River. The natives, especially the wild bushmen, hunt it with considerable avidity. The flesh of the young ones is described as being both tender and of good flavour; and though the old ones may, from the vigour of their muscles, and the heavy exercise which these undergo, be a little tougher, we may naturally enough suppose that they would be acceptable to a people who do not hesitate to make a meal of the lion himself. The most valuable parts are, however understood to be the skin, as an article of domestic economy, and the marrow of the long bones as a luxury in the way of eating. The skin is described as being very tough, hard, and durable; and to those who like luxuries in the way of fat, the marrow is said to be a *bonne bouche*. It is generally in the way of curiosities, however, that the skins of these animals find their way, by the Cape of Good Hope, to Europe; and it was not till a comparatively recent period that these were common even in museums; and they were generally so mutilated that it was not easy to make out the characters of the animal from them. An opportunity was afforded some time ago to the curious in this country of correcting any mistakes that may have been made in this way, by the arrival of a living specimen, as a present to his late Majesty George IV. This one lived for some time in this country; but either the climate, the food, or both, did not agree with it, and it died. Its remains have, however, been preserved; for being presented to the Zoological Society of London, that society had the skin stuffed, and the skeleton set up in its proper arrangement and attitude; so that any one who chooses to visit the Society's Museum in Bruton Street may have an opportunity of studying a giraffe "skin and bone," if not in flesh and blood and its living economy.

In their native country those animals show their peaceable disposition in being partially gregarious. They are found in small flocks of about five or six; and from what has been said of the period of gestation, and the single young one at a birth, these cannot

be considered as families, or any other associations than those arising from simple attachment of the species to each other, upon the common principle of sociality among gregarious animals. This circumstance, together with the mildness of these majestic creatures, renders it highly probable that they might be domesticated by proper treatment; and though the best use to which a giraffe could be turned is rather an indeterminate problem in domestic economy, there is no question as to the great ornament which these animals would afford, if it were possible to breed them, or even to keep them, in collections of ornamental animals. It is probable, however, that before this could be done, they would have to pass through successive gradations of climate, and that even then the experiment might prove a failure.

Giraffes do not appear to live in the very close forests, near the river banks, where the giant vegetation of Africa has its growth. Their locality is rather in those places which may be considered as holding a mean proportion between the excess of tropical vegetation and the final sterility of the plantless wilderness. Those confines of the forests which are on the margins of the deserts and karoos, seem to be their chief localities. Those places are generally scattered over with trees, chiefly acacias, which do not form a perfect brush of underwood at the bottom, as is the case with the shrubs nearer the desert or the plain, and which brushy woodlands answer better for sheltering a lion or other powerful beast of prey, than the acacias in question. Still these acacias do not grow to any considerable height; and the young branches are pendent and succulent, and it is upon them that the giraffes subsist, at least for a considerable portion of the year,—for that portion when the ground under them is destitute of verdure and hardened like a brick.

Under ordinary circumstances, the giraffes browse their favourite acacias in peace and safety. It is true that the poisoned arrow of the Bushman sometimes finds them in these places, by his stealing upon them from tree to tree, till he gets within range; but probably this happens less frequently than in the case of any other African game. The eyes of the giraffe are, as we have said, admirably placed for keeping watch against danger from behind; and the stem of the tree which the animal is browsing, forms no bad defence to it in front. Then, if it is once alarmed, and trots or ambles off at its peculiar pace, which though, as mentioned by the old bishop of Siëca, it has a shambling appearance, is yet very swift, and it is one of those species of motion which an animal can continue for a long time. And if the giraffe is once alarmed and takes to flight, it is not very safe any more than very easy, to attempt coming up with him; but the reason of this we can notice to more advantage by and bye.

The lion appears to be the only wild animal of which the giraffe needs to have any fear; and as the lion attacks only from an ambuscade, like the Bushman, the same defence, or watchful protection, which guards against the one, serves also to guard against the other. The lion does not in general prey at those hours when the giraffe is feeding; and if he did, he could not spring upon the giraffe in any way but from behind, as there is the protection of the tree in front. It is said also, that even the claws of the lion, unless when he can get upon the ridge of the animal, and hold on upon both sides, do not penetrate

so far into the very hard skin of the giraffe, as to prevent that animal from shaking him off; and if it should succeed in this, the fate of the lion is as certainly sealed as when the elephant stamps, kneels, or otherwise crushes him to death, though it is sealed in a manner somewhat different. The defence of the giraffe is kicking; and from the vigour of its muscles, the length of its legs, and the consequent velocity of the hoof, when it comes to the position in which it can take effect, the kick is a truly formidable one, and it can be repeated with great celerity. The full effect of one kick is said to be sufficient to break the skull of a lion, strong as it is, and this is by no means unlikely, for the stroke of the kangaroo, which is a much lighter animal, can break the skull of a dog. The eye of the giraffe also sees to the rear, and can guide this its formidable weapon, both as to the time and the direction of the stroke; so that there is danger to any thing that may come within its reach. Even if the first kick should not be fatal, another can be made to follow so soon, that the stunned foe is killed or crippled before he can recover himself. The animal does not appear, however, to put this powerful weapon to the proof, except in cases of necessity; for its first attempt at safety is flight, and that is in most cases sufficient.

The times at which the lion is said to attack these animals with the greatest chance of success is, when they seek the water-courses for the purpose of drinking. This is usually in the morning; and the lion lies in wait at some place more elevated than that of his intended prey. When it reaches down for the purpose of drinking, all the advantage which its eye gives it when the neck is elevated is gone; and from the position of the fore-legs during this operation, it could not kick with the same force which it does when on the level ground, and in full command of itself. In this situation, the lion sometimes succeeds in fastening upon its back; and though the animal bounds off with great speed, the weight of the lion, and the pain of the laceration, which he inflicts both by claws and teeth, ultimately bring it to the ground, and when once there it is altogether helpless. Sometimes, too, when the giraffe, finding its food become scanty in those more open places which it frequents at other times, seeks the beds of the streams for such trees as may still remain there in a state sufficiently succulent for its subsistence, the lion, who has been crouching in a bush upon some commanding point, will sometimes spring to the attack, and chiefly from his elevation above the giraffe, succeeds in making it his prey. In general, however, we believe we may repeat that, with the exception of the elephant, which the lion seldom attacks, and of the rhinoceros, and the hippopotamus, which set him at complete defiance, or rather are perfectly indifferent to him in the peculiarity of their habitations, and the strong mail of their skins, the giraffe is less preyed upon than any other animal.

The giraffe, however, has its head quarters in a country which is very little known to modern travellers; as it has at most been visited only on the confines. Its principal country appears to lie nearly in the direction of the meridian, about twenty degrees east longitude from Greenwich; and it is rarely found near the coast along the whole extent. Although therefore the animal itself is now well known, its manners in those wild forests are to a great extent matters of mere guess-work, upon which it would be

equally unnecessary and unwise to enlarge. It seems, however, to be peculiarly fitted for making rapid way over rough and stony grounds, where scarcely any other animal could keep its feet even at the slowest pace; and its peculiar mode of ambling, in which it lifts two feet at each side alternately, and bounds along, almost as if it were a sort of biped, fits it remarkably well for clearing the large stones which encumber the surface of a country, so alternately burnt up by drought and scourged by heavy rains as that through which it has to pass.

We omitted to mention, when speaking of the characters of this singular animal, that it has neither a muzzle nor lachrymal sinuses; that it has twelve grinders and eight cutting teeth in the lower jaw, and twelve grinders without any cutting teeth in the upper; and that the female has four mammæ, which are situated in the groin.

GLADIOLUS (Linnæus). A genus of tuberous plants, and one of the finest ornaments of the flower-garden. The flowers are triandrous, and belong to the natural order, *Iridææ*. Generic character: spatha two-valved, grassy; corolla six-parted and rather gaping; stamens rising upward, bearing anthers attached to the filaments by their back, at a point a little above the base; stigma trifid, recurved; capsula oblong, three-sided; seeds winged. The Asiatic and European species have been long in our gardens, and known by the names of the sword-lily, or corn-flag; but a vast accession of species have been received from the Cape of Good Hope, some of which are most elegant plants. The European sorts do very well in the open borders; but the Cape species require to be treated like other bulbs from the same country, that is, potted in sandy leaf-mould, kept dry when dormant, fresh potted in October, and afterwards placed in a frame and regularly watered after they begin to grow.

GLAPHYRIDÆ (MacLeay; **ANTHOBII**, Latreille). A sub-family of coleopterous insects, belonging to the section *Pentamera*, sub-section *Lamellicornes*, and family *Scarabæidæ*, belonging to the group which feed upon the juices of trees or flowers (*Thalerophaga*), having the mandibles horny, concealed by the clypeus, the upper lip advanced, and the lobes of the maxillæ membranous. These insects appear to be confined to the old world, frequenting flowers, principally the vernal species, preferring that of the *Liliaceæ*; and, from the hairiness of their bodies, they must be very serviceable in promoting the fecundation of plants.

The genera are: *Glaphyrus*, *Amphicoma*, *Anthipna*, *Chasmopterus*, *Chasme*, *Dichela*, *Lepitrix*, *Pachyenemus*, *Anisonyx*, and some others; the majority comprising insects of small size, but considerably variegated in their colours.

GLAREOLA (*Pratincole*). A very peculiar genus of birds, ranged by Cuvier in his order *Echassiers*, or stilt birds, and forming one of those three small families which stand in a great measure apart from the rest. Those doubtfully classed birds are the carrion bird of New Holland, the flamingo, and the genus under consideration, none of which agrees in all respects with the proper stilt birds; and two of them, the carrion bird and this genus, are not stilt birds at all, for they have very short legs; and it does not appear that they are in any way fitted for wading, or given to such a practice, though all the three families frequent the margins of the waters.

The characters of the present genus are, the bill short, conical, arched in its whole length, with the gape wide, and in its general form bearing a very considerable resemblance to the bills of the gallinidæ, with which, however, the birds have little in common; and they have even less resemblance to partridges, although they have, strangely enough, been called sea partridges, both in Britain and in other countries. Their wings are very long and pointed, longer, indeed, than the wings of any known species. In some of the species, too, the tail is very much forked; and the whole apparatus of flight in the birds bears a considerable resemblance to that of the swallow tribe, with whom, also, they have been confounded by some naturalists, though they do not appear to have any natural affinity to these birds. Their flight, indeed, is something after the style of the swallows, or rather of the terns, but they differ from these in not having the feet webbed, except for a small space between the outer and inner toe. Their legs are of medium length, with scutcheoned scales on the tarsi; and not reticulated ones, as in the true wading birds. They have three toes to the front, and one to the rear, the latter of which touches the ground when they walk. They frequent the margins of the water, along which they usually fly in flocks, and utter loud and piercing cries; their food is understood to consist chiefly of worms and aquatic insects, the last of which they capture on the wing, beating the surface of the water for them something in the manner of swallows.

These birds are remarkable for the closeness and compactness of their plumage, upon which there scarcely appears a loose feather to retard their flight, even in the under covering of their wings. Indeed, their covering is altogether so compact, that it is not easy to discover in it much difference between feather and feather. Their colours are not gaudy; but they are in general rather rich, and well contrasted, so that on the whole they are very handsome birds.

They appear to be chiefly confined to the eastern continent, to the east part of Europe, and to central and southern Asia; but some of them are also met with in the south-eastern isles. Their power of flight is indeed such, that a few hundred miles, more or less, does not appear to make any material difference in the ease of their journeys. The species which is best known in eastern Europe, if, indeed, it is not the only species which is found there, does not come to the British shores, or even beyond the valley of the Danube, and not, as it should seem, even near to the head of that valley as a regular visitant. But still one will sometimes make a dash across; and as they have no western locality, there is no doubt that they come from those eastern countries which we have mentioned; and when they do come into Britain, they do not, as is the case with most of those eastern strays, alight on the east coasts of the country, or in latitudes corresponding to those which they inhabit when in their proper home. If one crosses the north sea, the chance is that it will not alight until it is on the most westerly of the Hebrides, or the northmost in the Shetland islands; and there, when one does come, which, however, is but rarely, it appears to be quite at home with the gulls and terns, which are abundant in these remote places. Such as come there show few signs of fear, and thus they become an easy prey to collectors of birds, by whom they are much prized on account of their rarity. There are several species, though some of them are not very clearly made out.

G. torquata (Collared Pratincole). The length of this species is about nine inches and a half; the plumage is subject to considerable varieties of colour. It inhabits the banks of large rivers, inland seas, and lakes, in the provinces which confine on Asia, and in most of the southern countries of that continent; is very common on the salt lakes and extensive marshes of Hungary; and is a stated or accidental passenger in some parts of Italy, Germany, France, and Switzerland, but is scarcely ever met with in Holland and Great Britain. One, we believe, was shot near Liverpool, and another specimen was shot in Unst, the most northerly of the Shetland islands, by Mr. Bullock. This bird darts with wonderful rapidity on flies and other insects that live among the reeds and rushes, and seizes them whilst it either flies or runs. It is a noisy restless bird; and the female seeks out the tallest tufts of herbage for her nest, where she lays from three to eight eggs.

Though this bird is subject to very considerable varieties of colour, some of which appear to be permanent, and yet attended with no other difference of character or of habits, yet the following may perhaps be considered as the prevailing colours of the full-grown birds of both sexes, which do not indeed appear to differ much from each other. The top of the head, the nape of the back, the scapulars, and the wing-coverts, of a greyish brown colour. The throat and fore part of the neck white, with a light rose-coloured tint, and this portion is surrounded by a very straight and well-defined band of black, which returns toward the angles of the gape; and it is from this that the bird gets the name of collared. The space between the eye and the bill is black, but there is a small crescent-shaped spot of white behind the eye. The breast is brownish white, the under coverts of the wings bright maroon red. The under part of the body white clouded with russet; the under tail-coverts pure white; the tail-feathers black, but with brownish orange margins, and the quills of the wings margined with the same colour, and deep blackish brown in the centre. The bill black at the tip and reddish at the base; the irides reddish brown; the feet reddish ash; and the circle round the eyes bright red. There is a variety of a greyish brown, deeper or paler in the tint, with the white on the throat clouded with bright russet; and this variety sometimes has the black collar broad, sometimes marked by a white line, and sometimes consisting of a row of spots. The young birds are brownish ash on the upper part, waved with darker, and with whitish margins to the feathers; the throat dull black; and the breast and belly dark grey, with brown spots. In this state of the plumage they have often been described as different species.

G. grallaria (Australian pratincole). The upper parts of this species are reddish fawn-colour; the quills black; the breast russet; the throat, fore part of the neck, rump, and tail-coverts white; the belly and flanks maroon brown. The anterior part sometimes marked with blackish spots, forming a sort of collar. The tail-feathers squared over at the end; the first quill very long and narrow; the bill reddish, and black at the tip, and the feet reddish; the length about nine inches; and the closed wings reaching nearly three inches beyond the point of the tail.

G. lactea (cream-coloured pratincole). All the upper parts of the body and the wings pure whitish ash; the quills and under sides of the wings deep black; all the under parts of the body pure white; all the

tail-feathers, with the exception of the outer ones, have a black spot upon each, which forms a large angular space on the closed tail. The bill is black with reddish margins, and the feet brown. The length of this species is much less than the others, it being not quite six inches. It is understood to inhabit India.

There are several other species of those birds mentioned by describers, as being distinct from those which have been enumerated; but when the differences consist in the colours or the markings only, they may be disregarded, from what we know of the proneness to variety of colour in that species with which we are best acquainted. The peculiar form and comparative shortness of the tail in the Australian one, leave little doubt that it is entitled to rank as a distinct species; and which differs from the others not only in size but in the peculiar form of its tail, which is much less produced and forked than in the collared species, but much more so than in the Australian one. These birds are a very peculiar race, but their motions are so rapid, and the marshy places which they inhabit are generally so inaccessible, that our knowledge of them is very limited.

GLAUCUS (Forster). A naked mollusc found in nearly every sea, but which has, hitherto, been erroneously figured and described with the foot uppermost.

GLECHOMA (Linnæus). A genus of two creeping perennial herbs, natives of Europe, and well known by the name of ground-ivy. The *G. hederacea* was once much esteemed as a medicine, and administered in pectoral diseases. Ground-ivy tea is still taken as an article of diet by poor people, and occasionally as a medicine; and cases are on record in which it has been useful for hypochondriacal patients. It belongs to *Labiata*.

GLEDITSCHIA (Linnæus). A genus of hardy deciduous trees, natives of North America and China. Class and order *Polygamia Diœcia*, and natural order *Leguminosæ*. Generic character: flowers bisexual; calyx three to five-parted; petals from three to five, two sometimes united; stamens from three to eight; filaments filiform, free below; anthers erect, oval, two-celled; style simple, short; pod often very long, interrupted by contractions between the seeds, the latter merged in pulp, rarely one-seeded; the male flowers have a calyx in four or eight parts; corolla none; stamens four to eight. These trees are admitted into arboreta and ornamental plantations. They have the habit of the *Acacia* (Robinia), and some of them are remarkable for their large branched thorns, by which their boles are effectually defended from all climbing animals. Not even a bear could ascend the *G. horrida* with impunity.

GLOBBIA (Roscoe). A genus of fine plants, belonging to the first class and order of Linnæus, and in the natural order *Scitamineæ* of Jussieu. Generic character: calyx somewhat tubular and three-cleft; corolla double, the exterior three-parted, the interior one-lipped, with two teeth at the base; stamens with linear filaments, not produced beyond the anthers; style filiform, bearing a concave stigma; capsule associated. These plants are easily cultivated in the stove, grown in sand and peat earth. In India and China they affect the sides of ponds, and there grow luxuriantly.

GLOBE THISTLE, is the *Echinops sphærocephalus* of Linnæus. Like all other thistles, it belongs

to the natural order *Compositæ*, and is found wild in the central countries of Europe.

GLOBULARIA (Linnæus). A genus of herbs and undershrubs, natives of the south of Europe. Linnæan class and order, *Tetrandria Monogynia*, and to the natural order to which it gives a title, *Globulariæ*. Generic character: flowers aggregated in round heads; receptacle chaffy; involucre imbricated; calyx in five persisting divisions; corolla in five irregular divisions; stigma simple; caryopsis loosely involved in the calyx; embryo inverted. The globularias are pretty flower-border plants, affect a sandy soil, and may be propagated by cuttings or seeds.

GLOBULARIÆ. A natural order, containing only one genus, whence it derives its title. The species are Alpine plants, bearing pretty blue flowers; some of them are purgative, and, as such, are found in the list of drugs. The *Globulariæ* differ so little from the *Dipsacæ* in their general structure, that, were it not for their free superior germen, they might be associated immediately with them, at least they might very well stand as a sub-type, for they are an instance of the close connexion which exists between these types, and thus become another evident link in that beautiful chain of affinities which pervades the whole vegetable kingdom, associating and assimilating the most distant, and apparently the most discordant parts.

GLORIOSA (Linnæus). A genus of bulbous or tuberous-rooted plants, natives of India. Class and order, *Hexandria Monogynia*, and natural order *Tulipacæ*. Generic character: corolla of six petals, reflexed from the base, petals lanceolate, pointed, wavy, and very long; stamens below the germen; filaments awl-shaped, elongated, spreading; anthers incumbent; style like a thread, inclining; stigma trifid; seed-vessel three-celled, three-valved; seeds globular, and disposed in a double series. The botanist who first discovered this plant must have been enchanted by the sight, because he bestowed upon it the high-sounding name of *Gloriosa superba*. It is really, however, a magnificent plant even in our hothouses, and in its native bed must be indeed glorious. They are flowered frequently in our hothouses with the necessary culture of planting them in turfy loam, sand, and moor earth, placing them in a hotbed-frame till they begin to produce their long dangling stems; then remove them to a warm part of a stove where there is room for the stems to advance, and be trained on a wall or to a long stake. They flower in the summer, and the stem dies down in the autumn, after which it is necessary that the roots should be kept perfectly dry till the next spring. They are then re-potted, and plunged in a brisk heat of the bark-bed, and at all times moderately supplied with water. They are increased by division or by seeds.

GLOSSODIA (R. Brown) is a genus of plants belonging to the natural order *Orchideæ*, and found naturally in New Holland. It thrives in sandy loam and moor earth, and only requires water when in a growing state.

GLOSSULA (Lindley). An orchideous plant indigenous to China, lately introduced to European collections. This plant is called *Glossaspis* by other authorities.

GLOW-WORM. A small luminous insect, belonging systematically to the order *Coleoptera*, al-

though destitute of wings or wing-covers, section *Pentamera*, family *Lampyridæ* and genus *Lampyris*, which see for the systematic characters of the insect. One species only of these insects inhabits this country, namely, the *Lampyris noctiluca*, which is to be seen amongst grass and low herbage upon banks during the summer evenings, emitting a beautiful clear greenish light from the underside of the extremity of the abdomen, not much unlike that of phosphorus. It is the female, however, which is generally observed to emit this light in such situations, the male being a smaller and more active winged animal, totally unlike his sluggish partner. Some of



The male and female Glow-worm.

our poets have indeed supposed that this was not the case, giving to the male the admiration resulting from this beautiful appearance: thus Cowper, in his verses on this insect, says

“ this truth divine
Is legible and plain.
'Tis power almighty bids him shine;
Nor bids him shine in vain.”

And Shakspeare, alluding to the supposed cessation of the luminosity before day-break, tells us that

“ The glow-worm shows the matin to be near,
And 'gins to pale his ineffectual fire.”

It is, however, to the females that these writers have alluded, and the especial possession of such a power by individuals of this sex has led to the idea that the light is given to them for the purpose of attracting the roving male and disclosing to him the retreat of his mate.

That the possession of this light is of far higher importance in the economy of the insect than the supposed use of which Cowper sings, viz.—

“ To bid the traveller, as he went,
Be careful where he trod;
Nor crush a worm, whose useful light
Might serve, however small,
To shew a stumbling-stone by night,
And save him from a fall.”—

cannot be questioned; and when we remember the propensity of many nocturnal insects to fly towards a light, and which is exhibited not only by moths but also by many species of beetles*, we may, with Dameril, regard this phosphorescent light as “the lamp of love—the pharos—the telegraph of the night which scintillates and marks in the silence of darkness the spot appointed for the lovers' rendezvous.” It may, indeed, be objected to this supposition, that there are various other species of nocturnal insects which are in a condition similar to that of the glow-worm, namely, the males winged and the females apterous,—

* Mr. Main states that the male glow-worms have been seen in such numbers as sometimes to cover a table round a lighted candle in an open room. And Mr. Bird, in his account of moths captured by means of a lamp near Reading, includes, “as might be expected, the male of *Lampyris noctiluca*.”—*Ent. Mag.* ii. 41.

and yet, being also night-fliers, the females are destitute of any light. But here the analogy will not hold in both cases: in the moths the males are furnished with beautifully feathered antennæ, and so long as we are ignorant of the uses of these organs, it is not too much to assert that they may give to their possessors powers of appreciation or senses which those species which have simple antennæ are destitute of; and this is the case with the male glow-worm, although in various popular works, lately published, these organs are represented as much feathered as in the moths.

In the "Journal of a Naturalist" we find the generally received opinion endeavoured to be supported by the structure of the thorax of the male glow-worm, which is so formed that when *at rest* no portion of his eyes are visible; but the head is margined with a horny band or plate, under which the eyes are situated, and which prevents all upward vision, as well as greatly to impede the view of lateral objects; so that by confining his view in his nightly flight to what is before or beneath him, his search is greatly facilitated. It is true that the structure of the thorax of the female glow-worm is similar to that of the male; but it is only when *at rest* that its position is such as is described by the author of the "Journal." The membrane which connects the head with the anterior cavity of the thorax is in these insects much more pliant and extensile than in any other beetles with which we are acquainted; so that when *employed*, the head is as much exerted as in other beetles; so that when taken in conjunction with the large size of his eyes, the male glow-worm possesses a greater field of sight, owing to the flexibility of the membranous neck, than most other beetles. But it has been further objected, that the popular theory cannot be maintained; first, because in the earlier stages of the existence of the female insect it is slightly luminous*; and, secondly, that the males also possess in a small degree the same power. The principle of gradual development, however, is surely a sufficient answer to the former objection, and we cannot see why the circumstance of the males being luminous should be a reason why they should not be attracted by other lights;—moreover, why should not the female be supposed to possess a similar propensity of approaching luminous objects as the male? In some of the exotic species the males are as luminous as the females, and the latter furnished with wings; and can it be supposed that the latter would not be attracted either to a lamp or to the light of the male?

The habits of the glow-worm have been recorded by various authors; the most interesting accounts which we have met with are those given by Mr. Wilson, in his *Entomologia Edinensis*, by W. H. White, in the *Magazine of Natural History* for November, 1835. The latter gentleman having collected some females towards the end of June, confined them, with a male, in a glass jar, with sand two inches deep at

the bottom, covered with moss, kept damp. After various experiments, he discovered a female half buried in the shell of a snail (*Helix nemoralis*), in the act of feeding upon the inhabitant; he accordingly supplied his captives with snails, upon which they thrived well, eating for the whole day without intermission, after which they fasted for eight days. About the middle of July he observed one of the females depositing her eggs amongst the moss; a week after which she died—the remainder also died at the beginning of the following month. "The eggs," he proceeds, "were of a pale yellow colour when deposited, and instantly emitted light; and I found, when I had occasion to sprinkle the moss with water, that the eggs emitted a stronger light; they became a little darker in four or five days. On August 27th, the larvæ began to appear. They were rather lighter in colour than the eggs, but became gradually darker as they advanced towards maturity. They had, when young, the power of emitting light or otherwise at pleasure. In sixteen days three of the larvæ ceased to eat (snails?), and retired to one side of the jar for the purpose of moulting or casting their skins, in which operation they appeared to suffer much; they became very weak and languid, and ceased to emit light. The operation being at length overcome, two whole days passed before they appeared to have strength to partake of food; but after they had once or twice taken nourishment, they became more lively and vigorous, emitted a much stronger light, and seemed to make amends for their long fasting by eating, if I may so speak, with double voracity. On the 10th of May following (making a period of nearly nine months in coming to perfection) three of the larvæ ceased to take food, and, as I thought, to prepare for another moulting; which indeed was the case, but instead of a lively worm I soon found (on the 13th) that one of them had become a chrysalis, and the other two changed into the same state on the 15th. The chrysalis, at first, appeared of a yellowish colour, but soon deepened into a reddish-brown. In the course of ten days several other larvæ entered into the chrysalis state; whilst others, to my great astonishment, still continued in their larvæ state till the May following, making a period of one year and nine months; whether this was owing to any improper treatment, or whether they required longer time to arrive at maturity, a second experiment may be the means of convincing me. But to return to my chrysalides; the first, a female, arrived at perfection on the 30th of May; the second, a male, on the 3rd of June, and the third, a female, on the 5th. The skin of the chrysalis is so transparent, that the perfect insect, whether male or female, is easily distinguished through it."

The larva of the glow-worm very much resembles the perfect female in its form; it may, however, be distinguished by its larger size, and its colour, which is velvety black, with the posterior angles of the segments dirty red, and by the rudimental structure of its antennæ and legs; the former, instead of being composed of eleven joints, having only four; and the tarsi, instead of being five-jointed, consist of a single short piece. The mandibles, on the contrary, are much more developed in the larvæ than in the perfect insect, being sickle-shaped, and very acute in the former. The pupa resembles the perfect insect, except that the limbs are laid along the breast, and inclosed in a thin pellicle, the female pupa, of course,

* It is evidently of the early and not the perfect state of the insect of which the author of the "Journal of a Naturalist" speaks, when recording their motions at the end of September, and which he regarded as indications of a migration to winter-quarters by the perfect insect, adding, that "if we conclude that the summer-light of the glow-worm is displayed as a signal taper, the appearance of this autumnal light can have no such object in view, nor can we naturally assign any use of it to the creature itself, unless, indeed, it serves as a point of union in these supposed migrations, like the leading-call in the flight of night-moving birds."

exhibiting no rudiments of wings or wing-covers, which are possessed by the male pupa.

The nature of the luminous matter of the glow-worm has much excited the attention of philosophers. By Forster it was stated that the light was so strong and continuous in oxygen gas, that one might read by it with facility; and M. Beckerheim not only ascertained the correctness of this statement, but also discovered that the insects were capable of living not only in the different gases (muriatic and sulphurous excepted, in which they die in less than eleven minutes), but even in vacuo; also that hydrogen gas became detonating in consequence of the presence of these insects; that the light is produced by small luminous particles, which the insect can cover with a membrane, so as to stop the external appearance of luminosity; and that after the removal of these luminous particles from the body of the insect, without endangering its life, it has continued to live, but without any re-appearance of light. Dr. Caradori, an Italian chemist, instituted an extensive series of experiments, which are detailed in Griffiths's *Animal Kingdom*, upon the *Lampyrus Italica*, for which, however, we cannot devote more space than to give the following short particulars:—The phosphorescence is a property independent of the life of these insects, and it is attached rather to the degree of softness of the phosphoric substance, dryness suspending the light, whilst softening in water regenerates it, but only after a certain period—a remark also made by Reaumur and Spallanzani upon the *Phelades* and *Medusæ*. He also tried upon the *Lampyrides* and their phosphorescent matter the action of the different saline and spirituous fluids, in which they have exhibited the same sort of phenomena as the other phosphoric animals, the phosphoric matter undergoing a dissolving action only through the medium of water.

But phosphorescent matter is not of itself luminous, it being necessary that it should be brought into contact with oxygen; and Dr. Burmeister overcomes this difficulty by the following remark:—"If we imagine oxygen combined with the fatty substance or its albumen, respiration gives it luminousness; by means of respiration oxygen is deposited in the corporeal substance; each inspiration, therefore, makes the beetle shine; and, again, next to respiration the circulation of the blood appears to have considerable influence upon the light, for we know that the substance emits the light only when moist. Carus has also observed that upon each pulsation, and consequently upon each fresh wave of the blood, the light shines brighter*."

It only remains for us to mention the species of these interesting insects. Hitherto one only has been decidedly found in this country. By Stewart and Marsham, indeed, the *L. splendidula* was introduced as a native species, but incorrectly; the specimens belonging to the latter having proved, according to Mr. Stephens, to be only a stunted specimen of *L. noctiluca*, our common species, and which appears to be generally distributed throughout England; near London we have found it at Combe Wood and Richmond Park, in Surrey, and it has been found on Kennington Common, at Hendon, &c.

There are, however, several other European species. The *L. splendidula* (found in the middle of Germany and south of France, and which is smaller than *L. noctiluca*). *L. zenckeri*, *L. Mauritania*, and *L. sencki*, agreeing with our British species in the apterous condition of the female and full-winged males. In *L. hemiptera*, however, the male has truncated elytra, and the female is entirely apterous. Dejean has accordingly formed it into a distinct genus, named *Geopyris*; whilst in *L. Italica*, *Piedmontana*, *Illyrica*, and *Lusitanica*, the female does not differ externally from the male, both having wings and elytra, although some entomologists, as Rossi, Illiger, and Carus, speak of apterous females of *L. Italica*; but they have evidently mistaken the larva for the female. These species, with other exotic ones, constitute Dejean's new genus, *Colophotia*.—*Catal. des Céopt.*, p. 301.

GLOXINIA (Heritier). A highly ornamental genus introduced from South America. Class and order *Didynamia Angiospermia*, and natural order *Gesneriæ*. Generic character: calyx superior, in five nearly equal parts: corolla tubular, swollen, bent, limb obscurely two-lipped, four or five lobed; stamens included, with the rudiment of a fifth; filaments inserted on a disc upon tooth-like glands, fixed on the germen; anthers two-lobed; style with a double-plated stigma; seed-vessel two-valved. The gloxinias thrive in a light rich soil. Individual plants flower best. *G. maculata* is increased by dividing the root. *G. speciosa* flowers abundantly, and strikes freely by cuttings. This plant is constitutionally curious, as leaves taken off close to the stem, placed in soil, and placed in heat, will emit roots and a bud, which shoots up to form a perfect plant.

GLYCYMERIS (Lamarck; *MYA SILIQUA*, Linn.) The few species of this genus yet known, have been blended by previous authors with the *Myæ*, from which their hinge however clearly distinguishes them; they are doubtless allied to the *Solen* and *Saxicava*, from the first of which they differ, having teeth at the hinge; and from the latter by the ligament being placed on the shortest side of the shell, which is transverse, widely gaping on either side; hinge callos without teeth, and with externally projecting callosities. The animal is unknown, and only two species are described by Lamarck, inhabiting the North Seas. The genus has been confounded with several others, and much obscurity exists respecting them. Many of the species appear to have been described by Daudin under the name of *Cyrtoderus*.

GLYCYRRHIZA (Tournefort). A genus of European herbs, some of which are cultivated, as the common liquorice for instance. The genus belongs to *Leguminosæ*. Liquorice is much cultivated in Spain, whence our chief supplies are drawn: it has also for many years been partially grown in England, plantations being formed at Mitcham, Battersea, Fulham, and other places in the neighbourhood of London; and formerly it was cultivated to a considerable extent at Pontefract, in Yorkshire; Worksop, in Nottinghamshire; and in other provincial districts. Stow informs us, that the "planting and growing of *Licorish* began about the first year of queen Elizabeth's reign." One hundred weight of the root will afford twenty-eight pounds of the extract, commonly known as Spanish liquorice, which, when purified, becomes much more agreeable in flavour, and is known as liquorice lozenge. It enters into the composition of several pectoral medicines, and is used to cover the nauseous

* Handbuch der Entomologie, § 282, translated by W. E. Shuckard, under the title of "A Manual of Entomology, from the German of Dr. Hermann Burmeister."

taste of aloes and other drugs ; but its chief consumption is among the porter-brewers. By the analysis of Robiquet, it has been shown that the sweetness of liquorice depend upon a peculiar form of sugar, which he calls *Glycyrrhizin* or *Glycion*. The roots also abound in amylaceous fecula, and contain a new crystalline substance, and a resinous oil, besides phosphate and malate of lime and woody fibre. *G. foetida* differs from the other species, by having a very disagreeable scent : the whole plant, when bruised, exhales a fetid odour.

GMELINA (Linnæus). A genus of East Indian trees, introduced into this country within the last twenty years : class and order *Didynamia Angiospermia*, and natural order *Verbenaceæ*. These plants grow freely in sandy loam, mixed with a little moor-earth ; and cuttings placed in sand under a glass, strike root readily.

GNAPHALIUM (Linnæus). A very extensive genus of beautiful and curious plants met with in every quarter of the globe. Class and order *Syngenesia superflua*, and natural order *Compositæ*. Generic character : anthodium imbricated, the inner scales channelled and partly coloured ; receptacle furrowed and downy ; florets of the ray imperfectly female and slender ; pappus hairy, rough, pencilled or feathery at top. This genus, called, from the firm texture and durability of the flowers, *Everlasting*, contained formerly many more species than are now enrolled under the above name. The new genus, *Helichrysum*, and many species of *Melalasia*, have been separated from *Gnaphalium*. They are cultivated in moor earth, and are easily raised from cuttings.

GNAT. A name applied to various small species of dipterous insects, having a long slender body and legs, and belonging to the Linnæan genera *Tipula* and *Culex*. More strictly, the name is given to such as are furnished with a long proboscis employed in sucking blood, forming the last-named genus, whilst, for the smaller species of *Tipulidæ*, the name of midge is more applicable. We would, if possible, wish that all the species of animals were furnished with vernacular names, feeling convinced that much more instruction is gained by the employment of such names, which, to a certain degree, familiarise the objects designated, and which is in fact the plan adopted in Germany ; but the poverty of our language will not permit this. Still there are instances in which vernacular names may be reclaimed, and this appears to us to be one of them. To the *Culicidæ*, therefore, we restrict the name of gnat ; and to the *Chironomi*, *Corethræ*, and other minute *Tipulidans*, that of midge.

We have already, in the article *CULICIDÆ*, given a short and generalised sketch of the characters and natural history of the family of the gnats. In the present article, therefore, we shall confine ourselves to those particulars which are at once brought to mind by the mention of the word *gnat*, namely, their blood-thirsty propensities, and the structure of the apparatus by which these propensities are indulged. In the generality of insects which fly by night, we perceive a general inclination to fly towards, and to be bewildered by light ; but this is not the case with the gnat. We have repeatedly watched its motions in a lighted room, and whilst the moth and the midge have been dashing round the candles, scorching their wings and burning themselves to death, the gnat has

been leisurely flying about the room in search of its prey, and at length settling upon our hand with a touch so slight as not to be perceptible. This latter circumstance, indeed, is so remarkable that it can scarcely be regarded otherwise than an instance of remarkable instinct. If it were, at such a time, to fly about with as loud a hum, and as blustering a motion, as at other times, its visit would at once be detected, and death or disturbance would be the consequence ; but instead of this, it exhibits in its coming as much wariness and care as a cat about to spring upon a mouse. We have, in the general article, *DIPTERA*, mentioned the remarkable circumstance that, amongst the whole order, it is only those species which subsist upon blood, that have the various organs of the mouth developed to their full extent. In page 288 of the present volume, we have given a figure of the mouth of one of these blood-sucking species, and requesting our readers to refer thereto, we will shortly describe the structure of the mouth of the gnat, which is similarly organised, premising only that its real structure has only been very recently ascertained, and that whilst Leuwenhocck supposed it to consist of only four pieces, Reaumur of five, and Swammerdam of six, it is in reality composed of seven distinct organs, exclusive of the palpi ; hence the figures given by Reaumur, are somewhat inaccurate in their minute details. In the mouth of the *tabanus* we perceive a large fleshy sheath, with terminal lobes, but in the gnat this organ is greatly elongated, so as to form a tube, or rather canal, capable, however, of being bent in the middle, and furnished at its tip with two minute lobes or lips. The six lancet-like pieces described in the mouth of the *tabanus* exist, but under a more elongated form, in the gnat ; and the pair of large flat palpi are also present, but variously modified in their form, and composed of four or five joints ; thus in the male and female *anopheles*, they are as long as the proboscis, the two terminal joints being much larger in the males than in the females, whilst, in the true gnat (*Culex prope*) they are as long as the proboscis only in the males, and very much feathered, whilst, in the female, they are very short ; other differences exist in the other genera of the family *Culicidæ*.

When, therefore, the gnat has taken its station upon the hand, or other part of the body, and ascertained, by the delicate structure of the small fleshy lips at the extremity of the external canal of the proboscis, the part most fit for attack, the internal lancets are protruded from the tip to a small distance, and, by their conjoined forces, a puncture is made in the skin, without, however, being felt by the victim ; by degrees the lancets are pushed deeper and deeper into the skin, the outer sheath becoming more and more elbowed in the middle, the bent part being directed towards the breast until the lancets being entirely buried, the base and tip of the canal are almost brought together, the intermediate parts uniting and forming a straight line. Hence it is evident that the analogy supposed by Swammerdam to exist between this sheath or canal, “ and the silver pipes (*canulæ*) used by surgeons, through which they pass their lancets into parts deep-seated, in order to prevent their wounding any other part than that which they intend to cut,” does not exist ; nor does the blood run up this canal, but ascends by capillary attraction into the stomach by means of the fine lancets. All this time the action of the gnat is not perceived, nor

is it until after it has taken its departure, satiated with gore, that the irritating action of the fluid, which it instils into the wound, in order to cause the blood to flow more freely, begins to be felt. We believe vinegar applied to the wounded part to be a serviceable remedy in assuaging the pain.

GNIDIA (Linnaeus). A genus of ornamental shrubs from the Cape of Good Hope. Class and order *Octandria Monogynia*, and natural order *Thymeleæ*. Favourite green-house plants requiring much care, as they are killed by either too much or too little water. Cuttings of the young wood root best. Moor-earth is most suitable for them.

GOAT (*Capra*). A genus of ruminant mammalia, agreeing with the rest of the order in their general structure, but differing in so many particulars, and corresponding so well with each other in the majority of these, as to form a very distinct as well as a highly interesting family. Of all animals which are reared in a state of domestication, goats are the most picturesque in their appearance, the most lively in their manners, and the most hardy in their constitutions. Of all four footed animals which have hard hoofs, they are the surest footed; and this agrees with their native localities. They are the inhabitants of the rocks, the tenants of the mountain-top, and the precipice, browsing on that vegetation which is inaccessible to any other race of ruminant mammalia. In this respect some of the antelopes approach nearly to them, as for instance the chamois, or rock antelope of the Alps; but fleet as that animal is, and great as is its power of endurance, it is by no means equal to the mountain goats. It is probably on account of the vigorous constitution of those animals and their consequent power of enduring the utmost severity of the elements, that the ancients chose *Capricorn*, or the goat, to represent that sign of the zodiac which the sun occupies during the greatest depth and utmost severity of the northern winter.

Goats, in one or other of the species, are found in almost every region of the world; and they are very obedient to climate in many of their appearances; but wherever they are found they are a lively, brave, and healthy race. Their skins are remarkable for the firmness of the texture, and the strength with which the hair adheres to them. Generally that hair is long and shaggy, but fine in its gloss, and remarkable for preserving that gloss for a long time after the death of the animal. In some peculiar climates this hair is longer and of finer staple, as in the goat of Angola, which country by the way is remarkable for the length and beauty of the hair in some other of its mammalia. In some other countries again, as for instance on the northern slopes of the Himalaya mountains, there are goats which are furnished with two sorts of hair, one which is rough and bristly, calculated for throwing off the heavy snows which fall upon their upland pastures during the winter; and another which is shorter, of finer staple, and superior perhaps to the covering of any animal for the purposes of domestic economy. The animals which are thus provided are the Cashmere goats, or rather the goats which furnish the materials of the splendid shawls known by the name of Cashmere; for the goats themselves are rarely met with on the south side of the summits, and will not live in the valleys or plains of the lower and warmer parts of India. The wool of those goats, which forms, as it were, their inner clothing, is not near so fine in the staple as the wool

of many of the sheep; but there is a durability, and also a facility of fixing permanent dyes upon it, both of which render it of great value in an economical point of view. And it may be said with truth that there is no tissue woven of any sort of material which lasts so long, preserves its colour so well, or is so difficult to be soiled, as a genuine shawl made of the hair of the cashmere goat. On this account these articles are esteemed the most valuable productions of the oriental loom; and as such they are favourite presents among persons of distinction in that country, the favourite abode of pomp and luxury; and though in point of beauty and design, and fineness of texture, many productions of the looms of Europe are superior, yet in durability the very best of them fall short of the genuine productions of India, if made of the unmixed covering of the shawl goat of the Himalaya.

Goats, in all the varieties of their species, are understood to be remarkably healthy and wholesome animals. Among their native rocks they browse upon vegetables much too hard for almost any other of the ruminant animals; and it is understood that scarcely any plant, be it what it may, is deleterious to a goat. It is also said that they are not only proof against the poison of reptiles, but that they feed with impunity upon those possessing the most deadly venom. This last is not very clearly made out, though it is by no means unlikely; because there are proverbs respecting it in some languages. Thus for instance, in the Highlands of Scotland, there is an old proverbial expression for gratuitous malignity, which states that it is "like the goat eating the serpent." As goats are more vigorous in their motions, and probably more energetic in their whole character than probably any other ruminant animals, the flesh of the full grown ones, especially the males, is more tough, and it has a peculiar flavour which many persons do not relish. Its colour is remarkable for depth, indicating that there is more blood in a goat than in almost any other animal; and it is remarkable as a physiological fact, that this general distribution of blood and consequent redness of appearance in the muscles of animals, is always in proportion to the degree of energy with which those muscles are exerted, or capable of being exerted. When prepared as hams the flesh of male goats, though exceedingly hard and peculiar in its flavour, is much relished by some persons; and in any one who wishes to "make a day" in climbing the rocks of a goat's country, there are few pocket companions more worthy of being recommended than some slices near the knuckle end of a goat's ham. At first indeed they look more like slices of flint stones, or rather of mountain jasper, than of any thing else, and they require some vigour in mastication. But, notwithstanding this, and notwithstanding their saltness and peculiar flavour, it is astonishing how those slices of goat's ham stimulate the salivary glands, moisten the parched throat, and allay thirst when one is breasting a steep mountain under the ardour of a mid-day sun.

The flesh of female goats when in proper condition is tolerably good; that of young kids forms a delicious and withal a savoury stew; and when goats are kept for the purposes of domestic economy, and the males are mutilated as is done with oxen and sheep, they get very fat, and their flesh is described as being excellent. The milk of goats is reckoned superior in many respects to that of any other animal. It contains less oil, and on this account it sits lighter

upon the stomach. Hence consumptive people are not unfrequently recommended to go to the goat-feeding districts, as a dernier ressort against that most direful of human maladies. With them, however, it is the whey after cheese or curds have been made, and not the entire milk, which is recommended; and even then it is probable that the fine air of the goat-country exerts as salutary an influence as the supposed medicine; but whether this be, or be not the case, is not much worthy of inquiry; because if valuable life can be saved (and as consumption is a disease of the young, the life of consumptive patients is always valuable), any circumstance that may bring them to the pure air of those clifly regions, which goats inhabit, is always worthy of being cherished.

It is a fact worthy of notice, that the remains of the goat, and also those of the sheep, have not been found in any of the accumulations of fossil animals; though, with the exception of Australia, which is very peculiar in its zoology, goats are found native in all the more extensive countries of the world. In all regions they inhabit the most wild and inaccessible places; and yet they seem to have a stronger attachment to the human race than almost any other animals; they are playful and familiar; and it is highly probable that the goat was among the first animals that man employed in a domestic state. An instance of this is mentioned by a very accurate naturalist, relative to the wild goats of the Alps: he and his party landed on a wild and romantic spot on the bank of the lake of Thun, where those animals are numerous, and left comparatively in a state of nature; but he and his companions had no sooner landed than these wild goats came bleating about them with their kids, and even entered the boat, and resisted being driven from it. They did this too evidently from mere attachment to the travellers, because the pasture was rich, and the said travellers had nothing in the shape of food wherewithal to tempt them.

The introduction of the goat and the ram into the zodiac by the very earliest astronomers, shows that the people who first cultivated the science of the heavens were familiar with these animals; and indeed there is reason to suppose that the human race, from very nearly the dawn of their history, domesticated and found advantage in those animals. The account given of the deluge in the book of Genesis, is too scanty for supplying any adequate materials for natural history; but it is recorded that the ark rested on the tops of the mountains. We have also evidence in Britain, and almost in every country, that the mountain tops were the habitations of men before they took possession of the plains; and that in those early times the plains were covered with thick forests, inundated with water, or so full of bogs and quagmires, as not to be fit for human abodes. In many places, both of England and of Scotland, we have evidence of early inhabiting and cultivation upon heights which are now bleak and wasted; and even the roads and stations of the Romans, though they must be referred to a comparatively recent period of history, are usually found upon the high grounds. In America too, when that country was first discovered by Europeans, the most civilised races of the natives were found upon the mountains; and generally speaking, when we look at the whole earth, we find that, with the exception of the lines of the shores, and the banks of the larger rivers, the people inhabited

the mountains, while the low grounds were abandoned to tangled forests and wild animals.

This circumstance naturally connects itself with the goat and the sheep as mountaineers, and renders it probable that both of these were domesticated at an earlier period than the ox, which, inhabiting lower down, may not have been brought under the dominion of man until the pastoral life had been partially changed for the agricultural. Accordingly we find that these animals make an important figure in the mythologies of many ancient nations. Pan, which is a symbolical personification of the productive energies of nature, was furnished with the attributes of a goat; in like manner the Lybian Jupiter was furnished with the horns of a ram. The *Ægis*, which was equally the breast-plate or shield of Jupiter and of Minerva, was originally nothing but a goat's-skin; and by the fable of those two divinities, the goat was thus connected with supreme power and supreme wisdom, which shows the estimation in which the character of the animal was held. Under the Jewish rituals the goat was an important animal, and used as the appropriate symbol of atonement in the splendid rites ordained by the Supreme Lawgiver himself.

The skin of the goat appears to have been early used as an article of clothing; and the first cloth, or rather felt, which was made by the northern nations, appears to have been chiefly formed of the hair of this animal, mixed with shorter fur, matted together, and stiffened with the gum of trees, so as to be proof not only against the weather, but in a great measure against the weapons of their enemies. This species of garment is very frequently alluded to by the ancient poets and historians.

The war tunics of the Cimbri, which, in their wars with Marius, are represented as being such strong defences, were of this material; and the Roman auxiliaries had winter dresses of the same, in Britain, and all the other colder provinces of the empire. Even when weaving from spun thread took the place of the more ancient matting, it is highly probable that the long hair of the goat was used in preference to the shorter wool of the sheep. We have further evidence of the early domestication of the goat, in the fact that all Celtic tribes, which are justly regarded as the most ancient races of many parts of Europe, bred and cultivated goats long before the introduction of sheep. In the Highlands of Scotland and in Wales, the goat was the original domestic animal; and in both countries there are many districts called by the name of *Gower*, which is Celtic for goat, and many families have the same surname, whereas no name of the sheep is used except in cases where the use of it is comparatively modern. All these circumstances render the history of the goat a highly interesting one; but it is long, and the details are hardly fitted for a work like the present, though a volume of great interest might be written on the domestic history of the goat.

Goats as a genus are distinguished from Antelopes by the bony nucleus, or core of the horns, being, in part at least, cellular, and the cells communicating with the frontal sinuses of the cranium. The horns are more or less angular, or ridged, with transverse knots and wrinkles. Their usual position is upwards and backwards; they are found on both sexes; but on the female they are much smaller in size, and more smooth in their surfaces than in the males. The line of the forehead is a little convex; the eye is very

lively and expressive ; the iris being generally brown or yellowish, and the pupil large and oblong, as in other grazing animals. There are no sinuses or openings under the orbits of the eyes, as there are in most of the deer and antelopes, neither is there any muzzle, the naked part being confined to a small space between the nostrils : the ears are narrow and rather rounded at the tips ; the tail is short, usually naked on the under side, and frequently carried erect. In almost all the species the males have a long beard ; and even in such as have the body covered with comparatively short hair, the hair on the throat and dewlap is long. The hair of goats is not coarse, but it is very strong, smooth, and straight in the staple ; and in almost all the species there is a fine woolly down among the roots of the longer hair. This down, where it is in considerable quantity, is of great value in the arts ; and indeed the whole covering of the goat is remarkable for its durability. The legs of goats are much stouter in proportion than those of the antelopes. They are furnished with a callous appendage at the joint, and the hoofs are high and solid. The females have two mammæ forming an udder in the groin ; they go five months with young ; the female is capable of propagating at seven months old ; and the birth usually consists of two kids, which are perhaps the most sportive of all young animals. The male does not come to perfect maturity until the expiring of a year ; and then a single male is sufficient for a flock of a hundred females. At five or six, the male is reckoned old ; but the full life of the goat may be estimated at about fifteen years. At all times, but more especially during the rutting season, he-goats emit a peculiar smell, to which the name of *hircine* has been given, from the word *hircus*, a he-goat. In the rutting season the males follow the habit of all gregarious animals, in battling keenly with each other for the possession of the females ; and though their mode of conducting those battles of gallantry is very different from that either of bulls or of rams, it is still very characteristic as well as picturesque. Bulls attempt to gore and toss each other with their horns ; and rams, retreating to a considerable distance from each other, return with so much acquired velocity, as sometimes mutually to fracture the skulls of each other, and when they miss their aim, they tumble and sometimes break their legs ; goats, on the other hand, rise up in their combats, and throw their whole weight in a curious oblique motion, which is very effective, so much so indeed, that a goat is more shunned by dogs and other carnivorous animals than the larger ruminantia. It gives its stroke very suddenly, and as it generally delivers its whole weight with great impetus against the ribs of the enemy, its attack is equally severe and difficult to be guarded against.

The tendency of the whole race is to climb to as high situations as they can. In a state of nature the whole of them inhabit the tops of the mountains, probably nearer the line of perpetual snow than any other mammalia of equal size. In a domestic state they also seek clifly places, from which they do not descend unless for the purpose of drinking ; and where goats are kept they add not a little to the picturesque effect of mountain scenery. When mixed with sheep on the same pastures, they invariably take the lead, and their more timid companions generally follow in their track. They are bold, impudent, and exceedingly capricious ; always on the alert, and

remarkably observant of every object around them ; and if that which they see is novel or dangerous, they instantly put themselves in an attitude of attack. They are among the most sure-footed of animals, and can pass along ledges of rocks of very narrow dimensions, upon the brink of the most frightful precipices. If two of them meet in any such situation as that now noticed, where there is no room for either of them to turn, the one crouches down and allows the other to leap over it, after which it rises again, and both pursue their journey with perfect safety. Bingley mentions a case of two goats meeting on the *Torus*, or projecting round moulding of the ramparts at the citadel of Plymouth, where the footing was very narrow, and the rampart overhanging the sea ; but the one contrived to crouch down, and allow the other to leap over it so that both pursued their dangerous journey in perfect safety, and in the presence of numerous spectators.

All their senses are very keen : they see to a great distance, and notice every thing around them ; and their sense of smelling, though themselves smell strongly, is very acute. In feeding they are very indiscriminate ; and many plants which are not only shunned by other ruminating animals, but act as poison to them, are not only eaten with impunity but relished by goats. There have been instances in which tame goats have chewed tobacco ; and in the wild state they eat the most bitter and narcotic plants, such as euphorbium, hemlock, henbane, and even digitalis, without suffering any injury. Few plants are more disrelished by cattle than the common ragweed, and therefore the pastures on those lands in upland and humid situations, are very much infested by it ; but goats clear it off, if allowed to browse the plants before they come into flower. There are many of the *compositæ* which are the pests of our pastures, and which are, generally speaking, biennials, making roots the one year, and bearing flowers the next, which might probably be cleared off, by pasturing with goats at proper times. The alternation with each other of animals, one set of which can eat the plants that are disliked by another, is an important point in the economy of our grazing districts, though it does not appear to have received that attention to which it is entitled. Indeed those who devote their attention to the rearing of domestic animals for profitable purposes, in general so confine themselves, both in theory and practice, to one species, that they neglect all others, and thereby seriously injure, and sometimes actually ruin the pasture grounds. It will be readily understood, that if a pasture land abounds in a plant which is disliked by any kind of grazing animal, that plant will be left, while those upon which the animal feeds are eaten up ; and by this means the plant which is injurious to the pasture will seed and multiply, and in time overrun the ground, and choke and extirpate those other plants which are accounted more valuable. There is not the least doubt that in this way many of the upland districts of the British islands have been converted from grass land to heath, and thereafter followed the natural progress from heath to peat, in consequence of having been grazed by black cattle only. In those districts where sheep-grazing has been introduced, which, in the north at least, is a much more recent species of grazing, the quantity of heath has diminished ; though in the more steep and wild places the sheep tracks have opened the surface to the rains, so that entire mountain sides have been

swept down to the naked rock, and ruined by the debris and rubbish the meadows at their bases. In situations where there is also a sprinkling of goats, it does not appear, at least so far as our observation has gone, that either of these consequences takes place, at least anything like so speedily; hence the admixture of cattle, sheep, and goats, and the judicious adaptation of the numbers of each to the natures of the pastures, is a point well-worthy the utmost attention of those who are proprietors of our mountainous districts, or otherwise take an interest in it. If the habits and feeding of useful animals, and the nature of soils and climates, and the progressive history of their vegetation were a little more studied, it would be all the better for the country; for there is no doubt that this species of ignorance does more real injury than is generally believed.

If plantations are an object, as they always are near the sea, for the sake of the bark and charcoal which can be afforded by judicious coppice cultivation, goats cannot be introduced without occasioning mischief, in consequence of the proneness which they have to bark the trees in winter, and gnaw the buds and twigs in the spring.

All the species of wild goats, which are not indeed very numerous, are remarkable for their activity among their native rocks; and though in forward running they are not probably equal to many of the antelopes, their single bounds, and the situations in which they take them, are superior to those of any other animals. If there is the least hold for their feet, so that they can get a point of rest for an instant, and thereby acquire an impetus, they will ascend a perpendicular wall or precipice fifteen feet in height; and it is astonishing how little hold will sustain them, and how speedily they will renew their leaps. It is generally said, and the saying is probable, that when they do lose their balance, and fall from the precipices, they contrive to fall upon their horns, in the same manner as a cat alights on its feet, and that they thus can tumble from a height of fifty or even a hundred feet without sustaining the slightest injury. Those which are found in the more elevated and rocky mountains, are represented as being able to ascend a considerable way between the perpendicular sides of a ravine. How they do this, and contrive to bound from side to side of the chasm, is not easily explained upon any principle of common animal mechanics; but it has been so frequently stated by authors whose descriptions are generally to be credited, that it cannot well be denied. How far the elasticity of the horns may aid them in this singular species of ascent, is not a matter that has been determined, or one which is easy to determine; but still the goat does ascend by leaping against one of the opposing faces of the rock, and alighting on the opposite face; so that the whole of the motion bears some analogy to an oblique billiard ball striking alternately on opposite cushions of a table, though the horns strike the one side and the feet the other. How these act so as to give an upward motion to the animal is a point not easily determined; but it is one which is worthy of study.

The boldness, dexterity, and hardihood of the goat among rocks, renders the wild goat one of the most hazardous species of game for the mountain hunters. They are exceedingly vigilant; and when alarmed or rendered suspicious, they can escape upwards, and they are said sometimes to throw themselves down upon the hunters, and tumble them upon the rocks,

in which case the hunter is dashed to pieces, while the mountain goat falls on its horns, and escapes unhurt.

Goats utter various sounds according to their age, and the feeling with which they are impressed at the time. The kids or young ones bleat, and their bleating, though sharp, is not unpleasant. When the older ones are alarmed, they utter a peculiar sort of whistle; and their general sound when preparing to repel danger is an indescribable sort of spluttering. In those wild places the females are strongly attached to their young ones; and a she-goat of the mountain tops can defend her kids from the wolf and the eagle with equal success.

Altogether they are animals of great interest, whether we regard their picturesque form, their vigorous action, or the readiness with which they can be domesticated, and the strength of their attachment to man when they are in that state. There is another point connected with the domestication of goats which is worthy of attention; and that is the great proneness which they have to break into varieties, according as their pastures differ. This tendency is one of the most remarkable evidences we have of the capacity of domestication in animals; and it is remarkable that the most domesticated variety differs from what we consider the unbroken natural species; it is always the more gentle in its disposition. Some remarks on this subject will be found on looking back to the article CAT, in a former part of this work; and we may repeat, that animals of that species which differ the most from the common brindled wild cat, such, for instance, as the three-coloured tortoise-shell cat, and the cat of Angora, are the most gentle in their manners. It is exactly the same with goats; and wherever there is a great departure from what is considered as the wild type, there is a corresponding gentleness of manners and attachment to mankind on the part of the animal.

The species of goats are but few compared with the numbers of the animals, and their general distribution over the globe; and from the tendency above mentioned of breaking into varieties, it is not very easy to say which ought and which ought not to be considered as a species. We shall therefore confine our observations to those which are the most definitely ascertained.

THE WILD GOAT (*C. Ægragrus*), is generally understood to be the parent stock of all the domesticated varieties of goats, much as these differ from each other



Syrian Goat.

It is the paseng of the Persians, and the bezoar goat of some other eastern nations, a concretion called bezoar being sometimes found in its stomach. The

horns of this species are of a brownish ash colour, uniformly arched backwards, but little divergent, and with a slight recurvature toward the points. In their section, they are compressed laterally, with sharp angular edges to the front, and with a sort of furrow which renders the edge sharper. These horns make an angle with the frontal bone; and are marked with projecting tubercles, between which the surface is slightly striated. Some of the authorities describe these tubercles as increasing with and indicating the age of the animal, but the point is not fully ascertained. Indeed the animal is naturally so wild, and can make its escape so readily, in places where it is not so easily followed, that it cannot be subjected to very accurate examination. On the posterior edge the horns are rounded; in the male they are sometimes three feet in length; but they are usually smaller in the females. The general colour of the male is greyish brown, with a dark line along the back and a black tail: the front of the head is blackish, darkest towards the nose, and reddish on the sides: the beard and long hair on the throat are reddish brown. The female is smaller than the male, and paler in the colour.

The wild goat is chiefly found on the eastern mountains,—in those of Caucasus, Persia, and various parts of Hindostan. That it exists in Europe is not very clearly made out. The ibex inhabits some of the more lofty mountains, where there are abundance of domesticated goats; and as the domestic he-goats breed readily with the female ibexes, it is very probable that those specimens, apparently intermediate between the common goat and the ibex, which have occasionally, though rarely been met with, are only hybrids between the wild and the tame goat. Indeed both the wild goat and the ibex vary so much in different countries, that is not very easy to draw a clear and satisfactory line of distinction between them. Indeed direct crosses between the domestic goat and the ibex are not uncommon in Switzerland; and the males of this cross are not only capable of breeding back to the pure blood of the goat, but are much esteemed for that purpose, as being larger in size than he-goats of the pure breed. Indeed it is probable that there is no muleism in the matter; but that the ibex and the goat may breed freely, so as that the mixed progeny may among themselves be prolific; for, of all the larger domestic animals, goats are probably the most free breeders.

The great distinction of the species is in the horns, and these are gradual. The ibex of the Alps has the horns remarkably square; that of Caucasus has them more rounded; while the Abyssinian variety makes an approach to the mountain wild goat, and that again to the domesticated ones.

In animals which are so flexible to climate, it is not easy to establish either a local or a progressive history with any sort of accuracy; and, therefore, we must either adopt the plan of endless detail, naming the goat of every locality, which is at once the most useless of all operations in natural history, or we must be contented to mention only two or three of those which have the most striking differences; and they are all different in country as well as in appearance, except in so far as they have been transported from one locality to another. In this respect the removal of goats does not appear to be so successful as that of some other animals. It is generally understood that the goats of the Himalaya will not live

even in the most hilly districts of peninsular India although the temperature there is said not to be very different from that of their native mountains. The vegetation differs very greatly, however; for, when we ascend the Himalaya as far as the region of the native goats, we meet with a vegetation which is quite European in its character; whereas, in the south of India, the mountain jungles are in part at least composed of bamboos. There is another thing. The goats of the Himalaya, especially those most valuable ones which inhabit the northern slopes of the mountains, and which are said not to be met with anywhere to the southward of the summits, inhabit



Jemlah Goat.

a country rendered moist from the stores of snow on its mountain tops, as well as occasional showers purging the summer. In the south of India, on the other hand, both in Dukhun and in Mysore, but more especially in the latter, there are many of the more elevated districts in which there is no rain for a considerable part of the year, and where the monsoon sometimes misses, and there is no rain for two years. Now, the Cashmere goat, or shawl goat, as it is called, is an animal well provided, by the nature of its covering, for enduring changes of the weather, and especially the falling of rain, and, from being thus qualified, it is not adapted for the burning drought which sometimes visits the central parts of southern India, above the Ghauts or passes of the mountains. Some specimens of this far-famed goat, which, after all, is merely a variety of the common one, have been brought to Europe, and, both in England and in France, they have bred freely. In 1828, a Mr. Tower obtained from the Society of Arts in London their large medal, for having produced a goat's-hair shawl equal to those of Cashmere, though both the growth and the manufacture of this country. This gentleman kept his Cashmere goats on a farm in Essex, and, from four first imported, his flock amounted, in a few years, to more than two dozen. We believe that those goats did not feed upon the rich pastures, or relish the vegetation of the ordinary grazing-grounds, whether native or exotic. The dry common was their favourite place of resort, and their most common food was furze, the prickly shoots of which they preferred to every other vegetable.

Considerable attention was paid to the keeping of these animals, and the fine wool was obtained by combing their common, or longer hair, with an instrument not very unlike the currycomb used for trimming horses. We believe that the fine wool is

procured in the east by a process nearly similar ; and it is possible that the fact of its being perfectly ripened on the back of the animal may contribute to its superior strength. It does not appear that the long hair is cast at the same season.

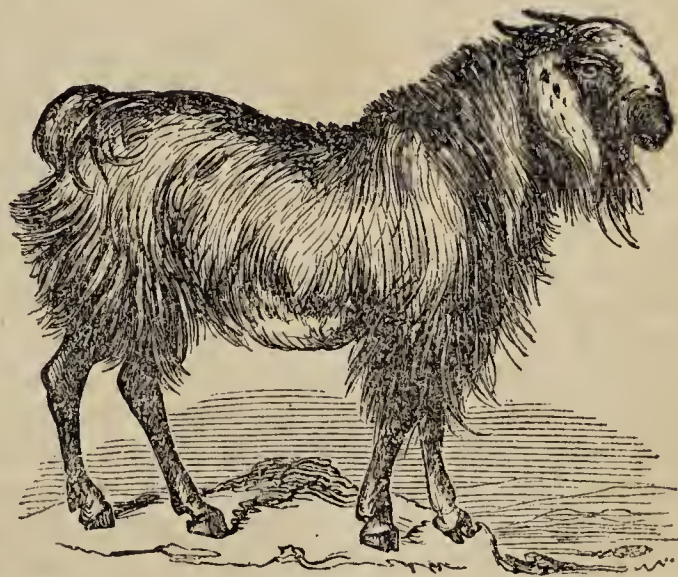
This experiment, and we believe those made in France have been as successful, from many circumstances connected with it, is well worthy the attention of those who cultivate natural history with a view to the promotion of domestic economy. At one time, it was very generally understood that the Merino sheep, producing the fine wool, could not be profitably bred in any part of Europe except Spain. It has been found, however, that the produce on the sandy plains of Saxony is finer than that from the original Spanish stock ; and so useful has the discovery proved, that in very many of the dry and sandy districts to the northward of the Carpathian mountains it has completely changed the character of the people's economy. In a great part of Poland, where woods are comparatively few, where the soil consists of sand and gravel, containing no mines, and where the people must, in consequence, subsist entirely on the surface-produce of the ground, that ground had been completely worked in tillage until it became comparatively unproductive, unless at a few spots advantageously situated. The first consequence of this exhausted state of a country is the falling off in the food of domestic animals, and a consequent diminution of their numbers. This, of course, diminishes the quantity of animal manure, and that diminution immediately tells upon the land in inferior crops. When this progress begins, it is of a growing nature ; and therefore there is not, in the power of common agriculture, any means of hindering it. It is the case with several of the poor and dry districts of England, which are far from fuel, and deficient in manure ; and, though it is probable that the whole is in a state of improvement as regards the cultivation of vegetables, it is highly probable, nay, absolutely certain, that many parts of it are fast declining in value. Now, we know no means by which calamities of this kind can be arrested upon the large scale, and the land brought back to fertility for tillage, but the depasturing of it by some species of ruminating animals. Hence it becomes very desirable to know, not only what ruminant can be bred with present advantage in any particular district, but what can, while it compensates the breeder for his labour, turn the tide-ruin from the land, and gradually bring it back to fertility.

The case of Poland, to which we have above alluded, and also of the light lands on both banks of the Oder, form experiments exactly in point. In very many instances, the farmers, especially those who migrated from Saxony, when so much of that state was annexed to Prussia, have ceased to be grain farmers. Indeed, they found the crops unprofitable, except on the rich bottoms, to which the substance of higher grounds is washed by the rains of autumn and winter. Thus they became shepherds, naturally imported the same valuable breed of sheep which had already succeeded so well in Saxony ; and thus, while their wool is a more marketable article, more easily carried to market, and really more profitable than the corn, a sword is gradually coming over many places, which, when the scanty crops of rye were cut down, remained nearly plantless throughout the year. As this has succeeded so well in the case of sheep, it would be at least worth while to try

Cashmere goats upon the bleak and dry commons of this country, because there is a point of sterility in such commons at which any attempt to graze them with sheep is a failure.

These remarks apply not only to the Cashmere goat, but to almost every species of the genus ; and any one who considers that we have, within the four seas, a thousand climates, and all varieties of soil, from the rich meadow, which scarcely any continuance of tillage will exhaust, to the plantless mountain-top capped with snow, it is not easy to point out from which place of the world a ruminating animal could be brought which would not find some spot in these kingdoms very nearly corresponding to its native locality.

This is one of the strongest inducements which can be held out for the scientific study of this useful class of animals in conjunction with the nature of those places of which they are natives, or to the circumstances of which time has, at all events, tempered them. Probably we shall resume it a little when we come to the article RUMINANTIA ; but it is an extensive subject ; in many respects it is a new one ; and we cannot resist the present opportunity of recording our opinion of its usefulness, and earnestly recommending our readers to promote it by every means in their power. Having done so, we shall return to say a very few words on the varieties and species of goats, which are in themselves matter of far minor importance.



Egyptian Goat.

THE COMMON GOAT (*C. hircus*, is found in almost every quarter of the world, though in considerable variety in the different districts, and almost every one is so familiar with its most common form, that a description of it is not necessary. In many parts of continental Europe, and those especially in which other means of subsistence and wealth are the most difficult to be procured, the common goat is of very great service. On the poorest pastures she-goats yield a good deal of milk, which, though it contains but little cream or oily matter, is both agreeable and wholesome. We mentioned already some of the uses of the bodies of these animals ; and we may add, that the skin is an article of great commercial value. That of the kid is the most flexible, the most handsome, and the most durable for light gloves and shoes ; and this answers well with the condition of kid's flesh, and the rapidity with which goats breed, that flesh being without any of the rankness and

hardness of that of the mature animal, and being in fact more juicy and delicate than lamb. In foreign countries, where goats are abundant, the skins of the mature ones are used for many purposes, being a substitute, and a very durable substitute, for various kinds of cloth. There is no skin which takes so fine a dye as goat-skin, and there is none of the same lightness and flexibility which is so strong. In Turkey, and other parts of the East, it is still used for the manufacture of what is called Turkey or Morocco leather; and though European manufacturers do what they can to produce imitations in sheep-skin, those imitations are vastly inferior to the genuine article.

Goat-skin is used for many purposes in the army. It forms the cover of the dragoons' holsters, and used to form the knapsack of the foot soldier. The whitest wigs, those which give a lawyer a sufficiently snowy head without the unseemly addition of hair-powder, are made of goats'-hair, bleached and baked; and there is no doubt but that an excellent wool might be obtained by combing any variety of the domestic goat at the proper season of the year. The goats of Angora, and of many parts of Syria, produce that hair which is spun into camlets, of which the consumption was at one time very great. They are now imitated with sheep's wool of a peculiar staple, spun in such a manner as to give the threads the hard appearance of the genuine camlet wool of the Levant; but the best of these imitations are vastly inferior to the real camlet, both in the fastness of their colour and in the time that they last. If a man gets a real camlet cloak, which has actually grown on a Turkish goat, he not only has a good garment for life, but may have a tolerable one to leave to his heir; whereas a single season, and often a single day, will, in many instances, completely spoil the best imitation.

In general, there is a traceable resemblance between the domestic goat and the wild goat of the mountain rocks; but the male is of inferior size, and the hair is of coarser texture, which is perhaps one of the most remarkable instances of change in the clothing of an animal. It is one, however, for which we ought to be prepared; for domestic goats, though they are principally attended to in upland districts, never are so high on the mountains as the wild ones. They are thus subjected to a less rigorous climate; and the tendency of a warmer climate is always to roughen, as well as to thin, the hairy coverings of animals. The horns, even in those varieties which most resemble the wild ones, do not incline so much backwards, and the tips are very generally turned outwards. The colours of these are various: some are black, or blackish brown, while others are sand colour, and others again are black and white. Those which may be considered as deviating the least from the natural state and habits of the genus, have the hair long and shaggy, although of fine staple, and remarkable for its strength; but there are others in which not only the shape, but even the number of the horns, differ from those of the wild goat; the coverings of their bodies are smoother, and tints of brown and reddish are blended with their colours. Some, also, have the ears pendulous; some are without horns; and some have more than two horns, of which last the Plate, GOATS, contains a specimen. To enumerate the various races of goats, all of which are, more or less, referrible to the same type, would be an endless, and not a very instructive task. The Persian goats have horns resembling in form those of

the wild goat, but smaller in size. These goats have the ears small and erect, and a conspicuous tuft of hair between the horns. The general colour is brownish ash, with rust-coloured points to the hairs. The Welsh goats, which are so well known as to be identified with the principality, are of large size, and the hair fine and long, and usually of a white colour. The horns of the males are of large size, often more than three feet in length. They stand nearly vertical in the greater part of their length, but bent outward at the tips. The dwarf goat is understood to be originally from western Africa, but it has thriven well in South America and the West Indian islands, where great numbers are to be found. They are, however, very much intermixed with other breeds, but always have a covering of short and close hair. This hair is varied with fawn colour and white on many parts of their bodies; but the produced hair on the beard and neck, and also the tail, is not unfrequently black. This variety is commonly without horns, and the ears are small and erect. It is very liable to break into differences, so much so that instances have occurred of the females having four mammæ. This race of goats is, generally speaking, more timid than most of the others. It is not a little remarkable, that the goats in Sweden, and those in the mountainous parts of Spain, bear a close resemblance to each other. These are generally Without horns, with long hair and upright ears.



Angora Goat.

In central Asia, where goats are much used in a domesticated state, there are many varieties, one of the most celebrated of which is the Cashmere goat, to which we have already alluded. It is remarkable for the length, whiteness, and silky texture of its hair. The horns are not so rugged as those of the common goats; and the ears are generally dark-coloured, and partially pendulous. The legs are very cleanly made; and altogether they are handsome animals. The under fur or wool, which is the valuable part of the covering, is white, readily dyed, and retains its colours with great tenacity. It is understood that this breed is confined to the higher parts of the Himalaya; and that when the valley of Thibet is arrived at, there is an inferior breed, which is, however, still valuable as a wool goat, though its wool is not of the same delicate texture as that of which the fine shawls are made. This breed has been introduced into France. The horns are not so brown as those in the former; the ears are less in size, and the legs are stouter in proportion to their length. The colour is more subject to variation from dark spots than that of the true Cashmere goats. The goats of Angora (see the cut) have the hair white, and generally long and very

soft; and their general expression is slightly that of the sheep. Their ears are large and of a buff colour; and the horns are upright in the males, but smaller and bending downwards in the females. The Syrian goat (see the cut on page 643) also has the hair long, but not so fine as that of the Angora goat. The Egyptian goat more resembles the goats of Europe (see cut, page 645). All these varieties have small horns. Some of the goats farther to the east have the horns much larger, as the Jemlah goat (see page 644).

The other members of this genus, which may be considered as differing in certain respects from the goats of common language, and partaking in part of the characters of the antelopes, are those to which the general name of *Ibex* has been given, but which has been qualified with different names in the species or varieties which are found in different parts of the world. Of these, one at least is European, one African, and one Asiatic; though the African one is met with in some of the adjoining parts of Asia, as for instance in Arabia. They are all mountaineers, and inhabit fully as high as those species of which the wild goat is considered as the stock and type; but they are less numerous in individuals than the goats, if we include the domesticated varieties along with the wild ones.

THE IBEX (*C. Ibex*). This animal is found, though rarely, in the Alps, still more rarely in the Pyrenees, and, as it is understood, in some other mountainous parts of Europe and Asia. The male has considerable resemblance to the goat, but has the head smaller in proportion, though the whole body is larger. The eyes of this species are large, round, and brilliant, and even fiery in their expression. The length of the full-grown male is about five feet, the height at the shoulder about two feet eight inches, and that at the rump about two feet ten inches. The horns are flat, with longitudinal ridges on the sides, and transverse furrows across; they incline backwards and outwards. It has been said that the transverse ridges of the horns mark the age of the animal, but the fact is not absolutely made out. When young, the ibex is light greyish ash, but the colour deepens when it comes to maturity; and it is then brownish in summer, and greyish in winter. Those animals have but little beard, not much dewlap on the throat; and their hair is at no time long and shaggy, but resembles that of the deer more than the goats. The dorsal line on the back is darker coloured than the rest of the covering, with the exception of the face, part of which is nearly black; the ears are small and erect; and the whole air of the animal is lively and vigorous. The ibex being esteemed a valuable prize by the Alpine hunters, has been almost exterminated on the Pyrenees; and it is comparatively rare on the Alps, except in some of the more elevated places of the Tyrol. The female when full grown has the horns about as large as those of a three year old male; and the prevailing colour is brown. The rutting season is in autumn, at which time the scent of the males is peculiarly strong. The sexes remain in company during the winter; but, as the spring advances, the females retire to the cover of the Alpine thickets, where they produce their kids. This takes place about April or May, and the young are very active, and carefully guarded by their mother.

The hoofs of the ibex are very firm in their texture, and are furnished with a sharp margin, like those in the chamois. The animals are very expert in leaping,

and the time between the leaps is so short that the animal resembles an elastic substance taking various bounds from mere elasticity, instead of an animal which has to renew its effort every time it touches the earth. When pursued they take to the glaciers, along which they can bound with great rapidity, and clear chasms of a good many feet, though in general they do not resort to such surfaces, as they furnish no food. They are gregarious, though the flocks seldom exceed a dozen, and rarely amount to so many, even in those places where the remains of the race are supposed to be most abundant. During the night, in stormy weather, and generally speaking in the winter, they resort to such woods and copses as are found in elevated places; and it is understood that they subsist, in part at least, upon twigs and bark, and even upon lichens. In fine weather they resort more to the open places, and are more scattered. The months of August and September are those in which they are in finest condition, and most earnestly sought after by the hunters. The flesh of the old ones is inferior to venison, but superior to that of full-grown goats; and that of the young is peculiarly fine. Altogether the ibex is an interesting animal, and it is not the less so from being found only in the most wild and inaccessible places, and being sought for at the very extreme of peril to the hunter. One almost regrets the success of ibex hunters, notwithstanding their boldness, and the hazards to which they expose themselves; for the animals are too fine for being upon the verge of extirpation.

THE IBEX OF CAUCASUS (*C. Caucasica*) inhabits the mountains after which it is named; and though it, upon the whole, has a considerable resemblance to the ibex of the Alps, there are differences between them. This species is broader and shorter in the body; of a darker brown colour on the upper part, and whiter on the under. The head is generally greyish, but with a black space round the mouth. The chin and upper part of the throat are whitish grey, but the breast is black, as is the dorsal line. The fronts of the legs are black, and there is a whitish streak on them behind; the horns are nearly two feet and a half in length, of a dark brown colour, and very solid. The hair, though not so much produced, is hard and rough, and thickly interspersed with grey wool among the roots. The females are smaller, and have their horns less; and in the male they are not so much roughened by transverse furrows and ridges as in the common ibex. The characters of the two species are very similar, and indeed it is doubtful whether this be not the more energetic animal of the two. Hitherto it has been observed only in the elevated parts of the Caucasus, but it is highly probable that it may exist in some of the other elevated mountains of central Asia.

THE IBEX OF ABYSSINIA (*C. Jaela*). This species, which appears to have been known to some of the ancients, and which is mentioned by some of the Jewish and Arabian writers, differs more from the two formerly mentioned species of ibex than they do from each other. It stands higher on the legs; and the hair on the greater part of the body is shorter and closer. The general colour is dun; and there is little beard on the chin of the male; but the throat and upper parts of the fore legs are furnished with long hair. The backs and fronts of the legs are marked with short and dark lines. The ears are very small, the forehead is rounded, the horns are larger than

those of the ibex, and each one is curved to nearly half a circle. They have a round edge to the front, and numberless small transverse furrows on the sides. This species, of which the natural history is not very satisfactory, is understood to be abundant in the mountains of Abyssinia and the elevated grounds on both sides of the Red Sea, so that it does not inhabit such elevated places as any of the other two species. We are, however, in want of further information respecting the wild animals of those parts of the world.

Such are a few particulars in descriptive history of those species of the genus *Capra* which appear to be best made out. Many others have been mentioned by different describers; but the tendency which the whole genus has to break into varieties, both of size and colour, renders it necessary to speak of them with a good deal of caution. It is possible too that where wild ones meet, there may be numerous crosses between them, which further adds to the confusion. Notwithstanding these circumstances, the goats are an interesting genus of animals, both because they appear to have been among the first, if not the very first, ruminating animals which man domesticated; and also because they take up their habitation in those places of the earth which, though they are the most sterile, are at the same time the most sublime; and there is a spirit about the animals themselves which increases their interest.

GOAT-MOTH (*Phalæna*, *Bombyx*, *Cossus*, Linnaeus). *Cossus ligniperda* of modern entomologists. The name of one of the largest species of British night-moths. It is of a grey colour, with numerous dark spots and lines on the wings. The larva, which is supposed to have been the celebrated cossus of the Roman epicures, feeds on willow-trees, which it bores in all directions, sometimes rendering them so weak as to be overthrown by the first high wind. This larva is a large fleshy looking grub, and emits so strong a scent, that its presence in a tree may be known to persons accidentally passing, hence the origin of the English name. It is this insect which has been the subject of a series of the most elaborate dissections by the celebrated Lyonnet, and which have rendered his name immortal.

GOBIOIDÆ. The Goby family, the twelfth order into which Cuvier divides the *Acanthopterygii*, or fishes with spinous rays to their fins. They belong to that division of the order which has a portion of the bones of the pharynx formed into cells partly cartilaginous and fitted with covers, by means of which a portion of water can be retained for the purpose of moistening the gills. All the fishes which have this peculiar form of the mouth, are remarkable for being able to live some time without water. They are, generally speaking, ground fishes, capable of crawling about from pool to pool, when the tide of the sea or the flood of a river leaves them; and some of them are capable also of making their way across the banks, and even of performing short journeys upon land. An account of one of the most remarkable of these will be found in the article **ANABAS**.

The Goby family have the spines of the dorsal fin slender and flexible, they have the same internal structure, namely an intestinal canal without cæca, and no air bladder. There are several genera in the family, one of which will be found noticed under the article **BLENNY**, and another under the article **ANARRHICHAS**, and others in the words referred to in those articles.

Though curious in their habits, none of these

families are very interesting in an economical point of view; and they are, generally speaking, very small in size.

THE TRUE GOBIES (*Gobius*) have the ventral fins united throughout their whole length, so as to form a concave disc. The body is lengthened; the head of moderate size; the cheeks puffed out, and the eyes near each other; they have two dorsal fins, of which the one is long. In general they prefer places having a clayey bottom, in which they excavate passages for their winter habitations. In spring they prepare a sort of nest, in which the spawn is deposited and fecundated, after which it is covered with sea-weed, to preserve it from the attack of enemies. There are a good many species inhabitants of the European seas, none of which are of much size, or any value, except as food for other fishes.

The black Goby, or *rock fish* (*G. niger*), is rather a rare fish on the British shores; and the following is the description of it, as given by Mr. Yarrell, from the manuscript of the late colonel Montagu. "The head is large, the cheeks inflated, and the lips very thick; the mouth is wide, and furnished with numerous small and very short teeth in several indistinct rows in both jaws; the under jaw is roughened by them like a rasp; the eyes are high up on the head, and approximate; the upper part of them dusky, partaking of the colour of the head, the lower part of the irides golden: between the eyes are two small pores, the anterior one more than double the size of the other, but not distinguishable without the assistance of a lens: the nostrils are placed before the eyes, on the outside of each of which is a small fleshy appendage, rather elevated: the cheeks and opercula of the gills are furnished with lines of very minute papillæ, which appear like spines; most of these lines are transverse, but some run longitudinally, observable only with the aid of a glass. On the top of the head a longitudinal sulcus runs as far as the commencement of the first dorsal fin. The colour is uniformly dusky in the matured fishes, except from the chin to the vent, which is whitish, with some deep purplish black between the gills beneath; the ventral fins usually more or less black. It is, when fresh, covered with a thick mucous secretion; but after having been in spirits, the fish becomes extremely rough to the touch if rubbed the reverse way. This roughness is occasioned by the scales, which are large in proportion, being ciliated at their free edges.

"The ventral fins, which supply the great generic character, are connected, forming a funnel-shaped appendage of twelve branched rays; and the anus is furnished with an elongated tubercle. We never could discover that the black goby ventured into fresh water, and with us certainly spawns in the sea. With respect to the union of the ventral fins, it would seem to be for the purpose of forming an instrument of adhesion; but in no instance have we observed that they adhered either to rocks, or to the bottom of the glass vessel, in which they have been kept alive for several days."

This species is found on the rocky shores, in all parts of the country, from Cornwall to the Orkney islands. The spawn is deposited on rocks; the young are plentiful in the summer, and the full grown ones do not exceed five or six inches in length. The ventral fins form a perfect disc.

The double-spotted Goby. This species has been named by Mr. Yarrell, from two dark spots on each

side, the one under the first dorsal, and the other near the base of the tail. It is a small species, only between two and three inches in length. It is found on many parts of the coast. The body is brown.

The spotted Goby. This species when full grown is about three inches in length; and is plentiful in the estuary of the Thames; but it is not used for any purpose except as a bait for other fish. The ground colour is pale yellowish white, freckled with small rust-coloured spots.

There are several other species or varieties; but they are too minute and unimportant to be entitled to any particular notice; and we shall mention the more interesting of the remaining genera that compose the family under their generic names.

GODWIT (*Limosa*). A genus of *Echassiers*, or stilt birds (*grallidæ* or waders), and which belong to the true marsh birds. They are of the *longirostral*, or long-billed division; and both in their structure and their habits, they hold a sort of intermediate place between the snipes and the avocets.

The generic characters are: the bill very long, soft and flexible throughout the whole of its length, slightly recurved or turned upwards, depressed, and flattened toward the tip. The two mandibles of the bill have furrows toward the sides. The upper mandible is longer than the under one; and there is a sort of knob on the inner side of it at the tip, against which the point of the lower mandible acts; and thus, though the bill is soft and flexible, it is capable of breaking a small shell, or bruising any of those little animals upon which the birds feed. The knob in the godwits is not, however, so well developed as in the snipes, and this forms one of the characteristic differences between the two genera. The nostrils are pierced in the furrow, and partially closed by membrane. The legs are long and slender, and bare of feathers to a considerable distance above the tarsal joint. There are three toes to the front, and one to the rear; the three front ones are rather long, and the middle and outer ones united by membrane as far as the first joint. The hind toe is articulated upon the tarsus higher up than the others. The wings are of mean length, best adapted for rapid and whirling flight, the first quill being the longest.

Marshes and the oozy banks of streams are the favourite haunts of the godwits. They are never to be met with in the open country, or on the margins of clear waters which have pebbly banks and beds. They are more aquatic in their habits than the snipes and woodcocks, but less so than the avocets, as they do not, like these, get into the runs of water, but dabble or poke in the silt and sludge. They get the generic name *Limosa* from their searching the slime of the pools and streams, and they are sometimes called "ooze-suckers," though they of course do not actually suck the ooze and sludge, but merely search it with their bills for the mollusca, worms, and other small animals which it contains. Sight can be of no use to them, and thus they depend on the sentient properties of the bill, as an organ of feeling or touch.

They are birds which consume the surplus produce of places which are very peculiar, and not only widely apart from each other, but subject to great seasonal changes. Thus the godwits are all birds of passage, shifting from one region to another as the seasons alter the characters of those places in which they find their food. At one season of the year the frost drives them from the more northerly parts of their range,

and at another the drought drives them from the more southerly. They are not, however, so exclusively migrants in latitude as those birds which feed upon vegetables, or upon larvæ and other animals, which depend in a great measure upon the seasons of vegetation. Their food is in the sludge, and there are so many and such varied little animals there, that, if there be the requisite quantity of moisture, in countries which are perennially suited to their habits, they remain all the year without migrating; and such countries are generally about the middle of the temperate latitudes. They breed in the marshes, a considerable way inland, if the situation suits them; but in the winter they descend nearer to the seas, and may be met with in the oozy bays and estuaries, though not decidedly in the salt water. When inland they conceal themselves among the aquatic plants in which they nestle; and when they come to the sea, they are abroad only at those times when the state of the tide is favourable for their very peculiar mode of feeding. The mornings and evenings are the times at which they are most upon the alert; and then they may occasionally be seen running about with great velocity, and poking in the soft and moist earth for those little creatures upon which they feed. They are, however, better known by their cry, which is shrill and peculiar, and bears some resemblance to the bleating of goats. Godwits belong to that class which the epicures term "gut-birds;" as such they are highly prized; and when they make their appearance in the London markets they fetch a high price, partly on account of their real value and partly from their rarity. There are several species, and two at least are British, though these, on account of their variations in plumage with age or with season, have been described as four or more.

THE BLACK-TAILED GODWIT (*L. melanura*) is the species best known to British ornithologists, and it certainly still breeds in the fens, though in fewer numbers than formerly. At one time or another it has got a great variety of names, and has been called a snipe, a woodcock, a plover, and many other things which it certainly is not.

The chief cause of the confusion which there is in the names and descriptions of the bird, appears to be the changes of plumage to which it is subject; but there are some characters which remain constant in all those changes, and by them it may always be known. The chief, and they are sufficient for the purpose, are the bill and the tail. In the bill, the curvature upward is so very slight that it cannot be discerned by the naked eye, without the application of something straight to it, and it is probably on this account that this bird has sometimes been called a snipe. The point of its bill is, however, not nearly so much thickened as in the snipes, which shows at once that the godwit seeks its food in softer mud, and therefore is closer to the margins of the waters than the snipes. One sees a very beautiful gradation in these birds, the snipes are very near the water, the godwits are close upon it, and the avocets are in it altogether. In the tail the permanent character is the colour; black in the two-thirds next the point, and white in the basal third. If these characters are attended to, the bird cannot be mistaken, whatever may be the colours of the rest of its plumage.

In its summer plumage the head of the godwit is reddish brown, streaked longitudinally with dusky-black. The lower neck behind, the back, and the

scapulars, are of a black colour, cross barred and more or less margined with brown. The wing coverts are brown, the lesser ones having white margins; the quills are dusky brownish black with white at their bases. A streak of a dull whitish colour passes over the eye, below this the cheeks, throat, fore neck, and breast, are pale reddish brown, and all the rest of the under part pure white; such is the black-tailed godwit in its nuptial attire. In winter, however, its colours change so much that we ought not perhaps to blame those who, before the habits of birds were so well known as they are now, called it by another name, and described it as a different species. In winter, the whole of the reddish brown on the fore part of the bird fades into pure white; the brown on the upper part becomes pale grey, and the black dusky brown; even the flying feathers of the wings become dusky or brownish, which is not the case in many of those birds which otherwise change their colour entirely with the seasons. Even the black in the tail fades considerably at this time; but it still maintains as much depth as to preserve the character of the bird. The black-tailed godwit is about seventeen inches in length, and three quarters of a pound in weight when in good condition, but the individuals vary in size and weight at different times of the year.

As noticed formerly of the genus, the black-tailed godwit is an exceedingly shy and hiding bird. It is all day in the tall herbage; and as it nestles and hides itself in the tufts and hummocks of the sludgy parts of the fens, it is very rarely seen in proportion to its numbers; and those numbers do not appear to be great, neither is the bird much distributed over the country. In north Holland it is by no means a rare bird, and it is probable that of those which appear in the fen districts of England during the winter the greater part come across from Holland; for, though this species is by no means a very discursive bird, or much given to migrate, the distance from Holland to Norfolk is not long for a flying creature, and the wind may often bring those to England which are shifting their grounds as the marshes of Holland begin to freeze, just in the same manner as that wind helps the birds of Siberia in an occasional visit to our shores. These birds breed inland in the fens, their nests are hidden, and the eggs, which are very rarely seen, are four in number. The young of the year have the plumage much more dingy and mottled than the old birds, so that they have occasionally been described as a distinct species. Indeed so long as colour was made a principal specific distinction among those long-billed fen birds, there was no determining how many there were; for summer and winter, young and old, and in some cases male and female, all had sufficient difference to mark them in this way. We shall offer some general remarks on these birds, and their localities and movements, in a general article *LONGIROSTRES*.

THE BAR-TAILED GODWIT (*Limosa rufa*) is the only other species which has been observed in England; and it is known only as a winter visitant. Even as such it is very capricious, appearing some years in considerable numbers, and in other years scarcely at all. It is generally said that this species comes most abundantly in those seasons when the other is rarest. This fact, which wants further confirmation before we can implicitly rely on it, might lead to something important in the distinction of the

two, respecting the causes why they migrate; because it would imply that a different kind of season drives each species from its continental haunts.

The bar-tailed godwit has its permanent characters in the same parts of the body as the black-tailed one. Its bill is considerably more curved, although even it has not a very great curvature, at least nothing compared to that of the avocet. The tail is throughout its length white in the ground colour, and regularly cross-barred with black. The tarsi are also shorter in proportion; and there are considerable differences in the tints of the plumage, although in this respect there is still a good deal of resemblance. In the summer plumage, the reddish brown on the head is more entire, and there is more reddish brown on the back. The summer tint of the fore neck and breast is also a more lively red; and there is no white on the bases of the quills. In winter the general plumage becomes greyish, and the red-brown on the breast fades to a greyish white. In this state, however, it is easily distinguished from the black-tailed species. The young of the year are entirely white on the under part, except the fore neck, which is mottled with greyish. The upper part is mottled with brown and greyish white, and the black bars on the tail are much smaller, and not nearly so well made out. In this state a random individual sometimes comes to our eastern shores about the middle of autumn. These are smaller in size than the mature ones, and have been described as the cinereous or ash-coloured godwit, of which Bewick gives a very faithful representation.

We have been thus particular in pointing out the distinctions between those two species of birds, and the various changes of plumage in each, not only for the purpose of so far correcting the pointed blunders which are in circulation respecting them, but because they are among the most curious of our fen birds; therefore information is desirable to those who have the opportunity of examining the fenny districts personally, which, of course, are those on the spot, and familiar with fen travelling. To ordinary persons, how zealous soever they may be in matters of natural history, there is a sort of *taboo* upon the fens; for he who could set at perfect defiance the briars and brambles of a common, the heath of a mountain, or even the ocean surges themselves, would hesitate a little to advance on concealed ground, where the very next step might plunge him neck deep in sludge as black as Styx.

GREAT MARBLED GODWIT (*L. fedoa*). This is an American species; and, as Wilson's description of it is the best, we shall quote from it as much as we deem necessary for our purpose. "This bird," says Wilson, "is a transient visitant of our sea-coasts in spring and autumn, to and from its breeding place in the north. Our gunners call it the straight-billed curlew, and sometimes the red curlew. It is a shy, cautious, and watchful bird; yet so strongly are they attached to each other, that, on wounding one in a flock, the rest are immediately arrested in their flight, making so many circuits over the spot where it lies, fluttering and screaming, that the sportsman often makes great destruction among them. Like the curlew, they may also be enticed within shot, by imitating their call or whistle; but can seldom be approached without some manœuvre. They are much less numerous than the short-billed curlews, with whom, however, they not unfrequently associate. They are

found among the salt marshes in May, and for some time in June, and also on their return, in October and November; at which last season they are usually fat, and in high esteem for the table. The female of this bird has been described by several writers as a distinct species from the male; the chief difference consists in the undulating bars of black with which the breast of the male is marked, and which are wanting in the female.

"The male of the great marbled godwit is nineteen inches long, and thirty-four inches in extent; the bill is nearly six inches in length, a little turned up towards the extremity, where it is black, the base is of a pale purplish flesh-colour; chin and upper part of the throat whitish; head and neck mottled with dusky brown and black, on a ferruginous ground; breast brown, with wavy lines of black; back and scapulars black, marbled with pale brown; rump and tail coverts of a very light brown, barred with dark brown; tail even, except the two middle feathers, which are a little the longest; wings pale, ferruginous, elegantly marbled with dark brown, the four first primaries black on the outer edge; whole lining and lower parts of the wings bright ferruginous; belly and vent light-rust colour, with a tinge of lake. The female differs in wanting the bars of black on the breast. The bill does not acquire its full length before the third year." It is not very clearly ascertained whether there are any more distinct species than this one in North America. It is not, however, unlikely, because North America is very extensively adapted to the habits of such birds. The same mistake has been committed with regard to the above species, as in those of England. Either the young, the female, or the male in a different plumage from what it generally appears in, in the same locality, has been described as the marbled godwit. In all probability it is the young, for the young of all these birds have the plumage much more mottled and broken than the old ones.

Species have been mentioned as occurring in Siberia, and also in the east of Europe; but it is doubtful whether these are true godwits. They appear rather to be snipes; and the shades of distinction between snipes and godwits are, in some species of snipe, so fine, that casual observation of the one without having the other to compare with it, is very apt to occasion mistakes. One who goes to a distant country requires to be a most experienced ornithologist before venturing to decide positively on minute specific differences, especially in such birds as those now under consideration. The snipes are puzzles in themselves, and the difference between snipes and godwits is equally puzzling; and in some cases it must, in part at least, be decided by locality. Indeed the only way in which one can get a clear and satisfactory view of the distinctions between those genera which inhabit nearly, but not altogether, the same grounds, is to take the differences of ground along with the differences of inhabitant. Now the snipes are very generally distributed, at least, over large tracts of the land, while the godwits are few in number, and their localities far more limited. The different structure of the bill is the chief organic distinction which leads us to this. The bill of the snipe is a boring bill, and from its straightness, and its consolidation at the tip, capable of penetrating mud of some consistency. The bill of the godwit, on the other hand, is a scooping bill to a very slight

degree, and not fitted for such boring as the bill of the snipe. If we carry the comparison a little farther from the godwit to the avocet, we find in that bird the scooping bill in its utmost perfection; and the avocet may accordingly be considered as the very last land bird which feeds in the waters; because beyond what the avocet scoops standing in the rivers, there remains nothing more to be done till the bird actually floats and dabbles, as is the case with the ducks.

In these birds we have the land birds fining off to a vanishing line, at which they gradually glide into the water birds; and it is not a little curious that in proportion as the shade in distinction between land and water becomes finer, the birds become fewer in species and numbers, and more limited in their geographical distribution. Snipes are abundant; godwits are far less so; and avocets are the least so of any, so that the number of species and of individuals is in exact proportion to the extent of pasture.

This is a beautiful instance of harmony and design in creation; and as we meet with it at a point where we are prepared for doing so, it strikes us the more forcibly. This, however, is the rational and instructive, as well as the delightful way of studying natural history; and really nobody but a poulterer has any business to know any thing about birds, unless he knows as much about the places which those birds inhabit.

We may mention here, because it will save room in another place, that there is one species of bird which is not uncommon in the north of Europe, and which has been called the *lesser godwit*, and the *Jadreka snipe*, which, though it is not, properly speaking, either a snipe or a godwit, was not unhappily named by Linnæus, *Sc. lapax limosa*, "the godwit snipe." The following is the description of this bird as given by Latham; and we believe it is correct in the details, though perhaps not entirely so in localities. "Length seventeen inches; weight nine ounces; bill near four inches long, dusky, the base yellowish; irides white; the head and neck are cinereous; cheeks and chin white; back brown; on the wings a line of white; vent and rump white; two middle tail feathers black; the others white at the ends, which increases on the outer feathers, so as the exterior ones are white for nearly the whole length; legs dusky. This bird inhabits, Iceland, Greenland, and Sweden. Migrates in flocks in the south of Russia; seen about Lake Baikal; and is said also to have been met with in England." This bird, which has the feet partially webbed, is very justly considered by Cuvier as intermediate between the godwits and the avocets.

GOLDEN ROD is the *Solidago virgaurea* of Linnæus, one of a large genus of herbaceous plants, common in every botanical collection.

GOMPHOCARPUS (R. Brown). A curious flowering genus of flowers from the Cape, closely allied to the old genus *Asclepias*. It flowers and produces seed plentifully in greenhouses, and is thereby easily propagated, or it may be increased by cuttings in the usual manner.

GOMPHOLOBIIUM (Smith). A genus of fine flowering plants from New Holland. It belongs to the tenth class of Linnæus, and to the natural order *Leguminosæ*. Generic character: calyx five-parted, parts nearly equal, broadly lanceolate; corolla standard, large, expanded, and emarginate; style incurved and deciduous; pod globular, and full of seeds. These plants grow best in very light sandy loam, re-

quire very moderate watering. Young cuttings root readily in sand, or they may be raised from seeds which ripen occasionally.

GOMPHUS (Leach). A genus of large dragon-flies (*LIBELLULIDÆ*, which see for the characters), having for its type the *Libellula vulgatissima*.

GONEPTERYX (Leach). A genus of butterflies, separated by Dr. Leach from the genus *COLIAS* (which see), chiefly on account of the angulated wings. The type is the brimstone butterfly of collectors, *Papilio rhamni* of Linnæus, a handsome species of a fine brimstone colour, found in most of the woods near London, and which makes its appearance very early in the spring.

GONOLEPTES (Kirby). A remarkable genus of arachnidous animals, belonging to the family *Phalangidæ*, having the hind legs very much thickened, elbowed and spined. The species are of a comparatively large size, and are for the most part natives of South America.

GONOLOBUS (Michaux). A genus of climbing perennials, natives of South and North America. The flowers are pentandrious, and, from the curious form of the parts, are arranged in the natural order *Asclepiadææ*. The plants are propagated by cuttings in the usual way.

GOODENIA (R. Brown). A genus of fine flowering herbs and under-shrubs, natives of New Holland. Class *Pentandria*, and natural order *Goodenoviæ*. Generic character: calyx five-cleft; corolla tubular, and one or two-lipped, limb in five parts, with colourless margins; anthers distinct; stigma a simple indusium, somewhat ciliated; capsule two-celled, with parallel partitions; seeds flat. They are easily propagated by seeds which ripen plentifully, or by cuttings.

GOODENOVIAE. A small natural order, containing five genera, and above twenty species. The genera are natives of the South sea islands; are herbs or under-shrubs, and are all rather pretty plants, and well worth cultivation.

GOOD NIGHT. An Indian hothouse-climber; is the *Argyreia* or silverweed of Loureiro, and the *Argyreia bona-nox* of Sweet; formerly the *Lettsomia bona-nox* of Roxburgh. Generic character: calyx of five conniving sepals; corolla cylindrically funnel-shaped; limb plaited, nearly five-lobed; stamens included, unequal; filaments joined to the tube, thick at the base; anthers erect, and arrow-shaped; style filiform; stigma double. Natural order *Convolvulacææ*.

GOOSE (*Anser*). A genus of web-footed birds, belonging to the flat-billed or *Lamellirostral* division, and the *Anatidææ*, or duck family. A slight notice of the relations in which the geese stand to the rest of the family, and also to some of the other orders which they approach, will be found in the article *ANSER*; and their general relations are noticed in the article *BIRD*. They are, however, too important, both in nature and in a state of domestication, to be passed over in the slight manner in which they are there noticed, and therefore we shall advert to a few of the more remarkable ones here.

Geese are very numerous, as well in species, or, at all events, in varieties, as in individuals. They are most abundant in the polar countries, and much more abundant in those regions of the northern hemisphere than of the southern. It is true that we know much less of the birds of the far south than of the far north; but the habits of geese are such as to

warrant us in concluding that they are by no means numerous in that part of the world. Geese are, with few exceptions, completely web-footed, and they all can swim. Swimming is not, however, their proper and peculiar, or, in general, even their chief motion. If the structure of a goose, and the way in which the legs support the body, are compared with those of a duck, especially one of the diving ducks, which range farther upon the waters, and are more constantly there than the common ducks, we shall perceive a very remarkable difference in the purposes for which they are best adapted. The bodies of such ducks are, as one would say, "boat-built;" that is, they are evidently formed for getting through the water rapidly at a small expense of effort; their legs, too, are placed far backward, so as to strike against the water, which follows in the wake, and this gives great advantage to the stroke, much more so than if it were given more in advance. Besides, they have the oblique motion, which throws the foot to a distance from the body, and partially turns it in such a way as that it can be brought forward with the least resistance. They are thus, strictly speaking, swimming birds; and though all of them have considerable power of wing, they are not less expert in the water than those birds which can fly comparatively little, although they are better at walking along the ground. The goose, again, is properly a walker, although the power of swimming is added, and in some of the species the two powers are nearly equal, and there may be some in which the swimming predominates.

Geese are also much more exclusively vegetable feeders than the rest of the family, at least with the exception of the swans; and the swans are much more aquatic in the feeding than the geese, for which habit they are well adapted by the greater length of their necks. Geese never dive, nor do they, in many instances, feed below the surface of the water, though they often feed, while swimming, on the seeds and succulent leaves of aquatic plants.

The generic characters are: the bill shorter than the head, higher than wide at the base, diminishing toward the tip, and thus having a slightly conical form. The teeth, in the margins and toward the tip of the bill, are conical, and the point of the upper mandible is generally furnished with a nail of harder consistence than the rest, and sometimes differently coloured. They are, generally speaking, polygamous, but there is no great external difference between the sexes. The old males are indeed rather larger than the females, but, before they reach maturity, the two sexes are very much alike both in size and colour, though this colour is, in many of the species, different from that of the mature ones.

The natural habitats of the geese are the damp meadows, and those tufted marshes which abound with plants, and they do not much frequent clear waters with pebbly shores. This species of pasture naturally points out why geese, in a state of nature, should be very migratory birds. In winter the land vegetation is covered with snow in every part of the northern regions, and this covering of snow generally extends to the shallow pools, and those tufts of vegetation which supply food for geese before the winter sets in. There is thus, therefore, nothing for them to eat on the landward part of the regions, in which they spend the breeding-time in the summer in the greatest number. The sea is, therefore, the only pasture

which is left open to such a bird as a goose in the high latitudes. In the extreme north the sea also is covered with ice, and with snow over that ice; and, even where this is not the case, geese are incapable of finding their food in the sea, even though clear of snow and ice to the high-water mark, which it seldom is, while the snow lies thick in the northern parts even of this country. Thus, in Scotland, though vast flights of geese pass over the country in winter, they never alight in the northern bays and estuaries, or on those deep lakes which have snow down to the water's edge. They come gradually southward, dispersing themselves over such of the inland pools and marshes as are not frozen, and as far to the southward, as long-continued frost and snow follow them, they move on; so that, in the course of a very severe winter, wild geese, of some description or other, range over almost the entire surface of the British islands. Their flight is high; and, though they do not alight except at such places as afford a prospect of food, yet there is no doubt that, from their situation at the top of the sky, they scan the whole horizon in their passage. It is doubtful whether any of them cross such mountains as the most lofty and broad-based of the Grampians, though they do make their way from the northern glens to the southern ones. Indeed, those marshy ponds, which are usually found about the parting of the water where two glens meet, are the places of favourite resort, more especially in the earlier part of the migration. The mode of flight is peculiar, but it can be better explained afterwards, when we are noticing those species most common in this country; but an attentive perusal of what we have said will easily show the reader why the geese necessarily leave their northern pastures during the winter, and also that, during this migration, they preserve, as nearly as they can, the same kind of feeding-grounds along its whole extent. It will also be seen, that those feeding-grounds are not frequented by any other race of migrant birds which the rigour of winter drives from the north, and hence one important use of geese in the economy of nature may be learned.

But there is another branch of the subject which is equally deserving of investigation, and that is, why, when they have escaped from the rigour of the northern winter, they return again? It has sometimes been satirically said, that "*A Scotchman is no goose*, for, when he migrates from the north, he seldom migrates back again;" and though this is only a little bit of pleasantry, there is more knowledge of natural history, to which it may be made a sort of artificial memory, than one would at first sight be apt to suppose. The Scotchman does not migrate northward, because he finds the southern pasture perennial, and, by parity of reasoning, the goose migrates northward, because to it the southern pasture is merely seasonal, and not perennial; and while barrenness sets in in the south, plenty begins to return in the north; and thus the geese are as true to their feeding instinct, or rather, as much impelled by the want of food in their voyage northward as in their voyage southward.

There again we may see, that how well soever the peculiar circumstances of the northern summer—the plentiful supply of food, and the long day, may assist those birds which migrate northward in summer, in the rearing of their brood, by enabling them to procure more provisions than they could possibly do in the south; yet it shows that the fact of migrating is

not, as has sometimes been supposed, a consequence of any instinct, or propensity, arising out of the disposition to breed. This is a very important point to be established, because the migration of birds appears a very mysterious subject; and as the tendency of the unreflecting part of mankind is to solve all mysteries by their own mode of procedure, that is by forethought, purpose and plan on the part of the creature, this is a very dangerous ground, inasmuch as it makes those animals rational, by placing them not only on a level with man, but considerably higher; and thus virtually destroying the foundations both of religion and of moral obligation,—a consequence which many of those who have been the warmest advocates of the doctrine, would be the last to countenance by open means, however powerfully their unwise and unguarded assertions may indirectly promote it. From what has been said in the case of the geese, it is perfectly evident that their impulse, both southward and northward, is the momentary, and merely animal one of the desire of food, and the impossibility or difficulty in finding it; and that when a goose makes a spring journey from Lands' End to Labrador, its speculation does not at any one time extend a moment into the future.

The circumstances of the southern and northern countries, as contrasted with each other, are of themselves sufficient to show that famine follows, or forces a goose northward to plenty in the summer, as well as southward to plenty in the winter. We take the argument in this article *GOOSE*, instead of in any other part of this work; because the goose is a very generally distributed bird; because its migrations when in a state of nature are very decided; and because those seasonal changes, in consequence of which it must migrate or perish, are more general, and certainly more imperious than in the case of any other bird.

As the congealing influence of cold forces these birds from the north, so the drying influence of heat forces them from the south. Early in the summer, when the east winds continue cold and dry for a succession of weeks, the pools disappear, and the vegetation on the upland places is retarded. This state of things continues gradually northwards as the year advances; and a different state of things gradually mingles with it, and becomes a maximum in respect of it, after a certain limit is passed, till, when we come to the extreme north, this new state of things entirely predominates over the other.

We use the word "summer" upon this occasion, as a general name for all that part of the year during which the productive power of the earth is on the increase; and according to this mode of division, all the remaining part of the year is winter. There are many cases in which this is a far more convenient mode of viewing the differences of the year, than the division of it into four seasons. Everywhere, at least without the tropics, there is a summer and a winter; but spring and autumn differ greatly in the different latitudes of the range. In the extreme south of it, spring and autumn may be considered of longer duration than summer and winter, while in the extreme north, the duration of both of these seasons is not only very much shortened, but in some cases nearly, if not altogether, obliterated. There are instances even in the north of Scotland, in which the wild plants come into bloom within a week or two after the melting of the snow, and other instances in which winter comes in

so rapidly, that the corn in the ear, before it has yet come to maturity, is buried under the snow. In consequence of this we must look at the extremes as being the points that turn the two migrations of the birds, and the mean latitudes as being a mere passage or thoroughfare. Now at the times when in such a country as England, the pools are dry, and the grassy surface is burnt up, the snows of the northern surfaces are melted. But the melting of the northern snows, especially on surfaces that are comparatively flat, is a very different operation from the watering of the ground by rain. In hilly districts, there are very frequently heavy falls of rain accompanying the break of the storm; because the great differences of level, and consequently of pressure as well as temperature, occasion varied motions and clashings of different strata of the air. On the northern flats, however, the case is different. The snows simply melt, and melt gradually; and the water stagnates, and stagnates upon surfaces which have been warm by the snow, while the air is comparatively cloudless, and the sun heats strongly. This state of things is exceedingly favourable to vegetation; and such a powerful growth is soon produced as preserves this humidity for the greater part of the summer; and thus geese find abundance of food in those northern wilds to which they resort as their breeding quarters.

In tropical climates the causes and also the directions of those birds are different, because they follow the periodical rains; but still the original inducement to migrate with the seasons is substantially the same in the one part of the country as in the other. It is food which the birds follow after in those regions as well as in the others; though that which drives them in both directions in the tropical countries is drought, and not cold.

We have a proof of the most important fact above stated, namely, that the want of food is the grand cause of migration in those geese which are domesticated in our farm yards, and on our commons. There is no question that all the original varieties of tame geese are from the common wild goose, though, since foreign races were imported, some diversity has been produced by crossing; and as geese, like all animals in a state of domestication, are subject to very considerable variations in size and colour, there are differences between the domestic geese of different districts, but still these are all the same in habit; and unless when they occasionally join the wild ones, which they do only in those remote parts of the country where wild ones are numerous, and human inhabitants few, they show no disposition to migrate, provided they are supplied with food; and then, if the dry common happens to be burnt up, their migration is only to the next humid meadow, where they find a sufficient supply of grass. We shall now briefly notice the principal species or varieties.

THE COMMON WILD GOOSE, or GREY LAG GOOSE (*A. palustris*). This is generally understood to be the parent stock of all the domestic species of Europe; and according to the accounts, it is now much less plentiful in England, even during the winter, than it was formerly. This is no doubt, in a great part, owing to the drainage of the fens, the increase of cultivation, and the greater breadth of land which has been covered with artificial plantations of trees; for the wild goose loves humidity, but shuns alike the corn fields and the woods. In some parts of the north of Scotland this goose still rears its young; but it is

doubtful whether there are any absolutely wild in the fens of England: though as geese are reared in much greater numbers, and more in a state of nature there than they are at the farmyards, and on the commons in other districts, they no doubt approach more nearly to the wild state.

The size varies a good deal; but the average length is fully two feet and a half, or even more; the extent of the wings about five feet; and the weight about ten pounds. This last circumstance, however, differs a good deal with the season. When the birds first make their appearance, they are very much exhausted, and their flesh is so lean and tough, that it is by no means desirable. There are various reasons why this should be the case. The length and fatigue of the passage, for their excursion is at least five hundred miles, and in many cases more, without any food by the way, is of course one cause; and another is to be sought in the very circumstance of their being driven from their northern haunts by their want of food. They do not of course move till they feel the pinch of hunger (for no animal does this), and thus they begin their journey in an exhausted state. Such of them as remain in the southerly places till the spring, are, however, in much finer condition; and though they are never so fat, the flavour of their flesh is superior to that of tame geese, and more nearly resembles game; and when they have been well fed, and not fatigued by laborious flights, they are tender as well as of good flavour. The colours of the common wild goose usually are:—the legs and bill flesh colour, with the nail on the upper mandible and the claws dull white. The eyes are grey, as also are the head, neck, and principal portion of the body. The coverts of the wings, and also the quills, have white edges, and the tips of the latter are black. The secondary quills are more or less black, and the tail is of a dusky colour, bordered with white on the edges and at the point. The breast and the belly are white with grey mottlings.

This species of goose is not so well winged in proportion to its weight as the smaller ones which visit the British Islands; and hence it is probably a more southerly bird in all its migrations, though it has been ascertained that some of these others still breed in the wild and remote parts of the north of Scotland. The flights of those birds, more especially on their southern migrations, and toward the middle of the latitudes over which they migrate, are by no means uninteresting. They fly in flocks containing from about fifty to a hundred individuals, pursue their flight at a very considerable elevation, and rarely, if ever, alight to rest during the day, unless in places where there is a considerable supply of food. Their peculiar cry may often be heard during the day, when they themselves are either entirely out of sight, or so elevated as to appear like specks on the sky; but when they alight they are comparatively silent, and as they feed chiefly during the night, contrary to the habit of geese when resident, and in the tame state, they are not often seen in proportion to their numbers. There is a considerable difference in their mode of disposing themselves when they alight merely for rest, which they do at certain wayfaring places; and when they alight for wintering or for a more prolonged stay. In the latter case they observe no particular order, but spread themselves over the pasture, whereas, in the former, they always alight in line, and have a watchman or commander, a little

detached from the rest. After they have rested for two or three hours, this one utters the same signal cry which is given out whenever a single cry is heard as they fly along, and as soon as this is given they are all on the wing, and in the order of their aerial march. Their flight is conducted with great regularity, for they always proceed either in a line a-breast, or in two lines, joining in an angle at the middle. They take the lead in this order by turns generally, the foremost falling back in the rear, when tired with cleaving the air, and the next in succession occupying its place. They are seldom within reach of a fowling-piece in these lofty flights; and even when they move in a lower track, they file so equally, that one discharge rarely kills more than a single bird. Their principal food consists of aquatic vegetables, and most sorts of grain. They breed in heaths, or in plains and marshes, as formerly in the fenny districts of England, and in various other countries, the female nestling on tufts of cut rushes, or dry herbage, and usually laying from five to nine eggs, and very rarely so many as twelve or fourteen. They are of a dirty greenish colour, and are hatched in about four weeks. The young ones are taken in considerable numbers some years, and are then very easily tamed. The old birds, however, are extremely shy, and possessing the senses of hearing and vision in a pre-eminent degree, frequently contrive to elude the approaches of their pursuers. They often during the day take up their abode in the fields of young corn, which they damage to a very considerable extent; but they remain there during the day only, and when night sets in, they invariably take to the water, where they are secure from the invasion of the fox, an animal which has long been proverbial as the destroyer of geese; and though the usual time for preying to the fox is the night or in the morning, he is so fond of geese as that he will sometimes steal upon them even at mid-day.

Many writers on the economy of these animals have stated that the species, in a wild state, is generally diffused over the world; but it is probable that in this there is a good deal of exaggeration; and it is not unlikely that even in the northern hemisphere this has been confounded with others, in like manner as those geese which are subject to differences at different ages and in different individuals have unnaturally been multiplied into different species.

This, which, as we have said, is understood to be the parent stock of most of our domestic varieties, has been so long in a state of domestication, that it reaches beyond the earliest records of history; and though, by some means or other, the goose has got credit for being emblematical of folly, there are some instances recorded of singular services performed by it to the human race. Geese are very watchful birds; and when any thing strange appears, they set up a loud gabbling. It is in this way that the geese of the Roman capitol are recorded as having saved Rome from being captured by the Gauls, and thus they were long respected by that very superstitious people.

When domesticated, highly fed, and left perfectly at case, geese grow to much larger size than they ever attain in a state of nature. Various arts, and often very cruel ones, have been, and are still, resorted to, for the purpose of fattening them for the table, and especially for enlarging their livers, which, when thus unnaturally enlarged, and consequently diseased, are much prized by a peculiar class of epi-

cures, although it is impossible that any part of animals which are treated in this manner can be wholesome. One mode of managing them is to nail the webs of their feet to a board on the floor near a strong fire, to sew up the vent, and forcibly to cram them with rich food, until they are at the point of death by suffocation; by this means the liver grows to an enormous size, and the goose itself increases in weight to twenty pounds and upwards. The fat of geese principally accumulates externally; and, generally speaking, it is difficult of digestion, and therefore unwholesome. In upper Languedoc, towards the Cevennes mountains, in France, there is said to be a breed which accumulates a great lump of fat on the lower part of the belly, which touches the ground when they walk. In other places there have been breeds that have showed considerable departures from the type of the wild goose, not only in colour, but in size and other particulars, which are understood to be less subject to those casual changes. It is mentioned that, a good many years ago, one family near Highworth, in the county of Wilts, were in possession of a breed of geese, which they nursed and fattened in such a manner, that they attained to a very extraordinary, and almost incredible size, insomuch that some of them would weigh from twenty even to thirty pounds. The owners could scarcely be induced, on any consideration, to part with an egg of this breed; and they sold the yearly produce of the flock to a few opulent families in the neighbourhood, at the rate of a shilling the pound. As an important department of the poultry establishment, the goose, we need hardly observe, is cultivated in almost every civilised quarter of the world, and, when under proper management, forms a profitable article of the farmers' produce, its quills, down, flesh, and even dung, being all turned to account. In this island these birds are nowhere kept in greater quantities than in the fens of Lincolnshire, several persons there having as many as a thousand breeders. They are stripped once a year for their quills, and no fewer than five times for the feathers. The first plucking for both commences about Lady-day, and the other four are between that and Michaelmas. It is alleged that, in general, the birds do not materially suffer from these operations, except cold weather happens to set in, when numbers of them die. The old ones submit quietly to be plucked, but the young ones are very noisy and unruly. These geese breed, in general, only once a year, but if well kept, sometimes twice. Each has a space allotted to it, in rows of wicker pens, placed one above another, during their sitting, and the *gozzard* (*gooseherd*) who drives them to water twice a day, and brings them back to their habitations, is said to place every bird in its own nest. The numbers of geese that are driven from the distant counties to London for sale are scarcely credible; for a single drove frequently consists of two or three thousand. In ancient times they appear to have been conducted much in the same manner from the interior of Gaul to Rome. The drivers are provided with long sticks, having a piece of red rag fastened to the end of them as a lash, and a hook is fastened at the other. With the former, of which the geese seem much afraid, they are excited forward, and with the latter, such as attempt to stray are caught by the neck and kept in order. Such as are lame are placed in a hospital cart, which usually follows each large drove. Their progress is at the rate of about eight

or nine miles a day, reckoning from three in the morning till nine at night. Those which become fatigued are fed with oats, and the rest with barley. However simple or awkward the goose may appear, it is by no means destitute of either sagacity or affection; and some singular instances are recorded of its attachment to animals of another class, and even to persons. The young, or *green geese*, as they are called, destined for the table, should be put into a place that is almost dark, and fed with ground malt, mixed with milk, when they will very soon, and at very little expense, be fit to be killed. Barley-meal may be mixed with water, should milk prove scarce, which they may constantly have by them to eat as they choose; and, in another part of the shed, some boiled oats and water, kept in a pan, to which they may resort, when inclined to change their food. This variety is agreeable to them, and causes them to thrive very speedily. *Michaelmas*, or *stubble* geese, should immediately after harvest be turned out on the wheat fields, where they pick up very fast; but when taken up to be fattened, they should be fed with ground malt, mixed with water, or boiled barley and water; and thus treated they grow fatter than would at first be imagined, and acquire a more delicate flavour than those in the London market. The old breeders may be plucked thrice a year, and at an interval of seven weeks, without inconvenience; but young ones, before they are subjected to this operation, must have attained to the age of thirteen or fourteen weeks, otherwise they will pine and lose their good qualities. It is scarcely necessary to add, that the particular nature of the food, and the care that is taken of the birds, materially contribute to the value of the feathers and the down. In those neighbourhoods where there is a good supply of water, they are not so subject as elsewhere to the annoyance of vermin; and they furnish feathers of a superior quality. In regard to down there is a certain stage of maturity, which may be easily discovered, as it is then easily detached, whereas, if removed too soon, it will not keep, and is liable to be attacked by insects and their larvæ. Again, the feathers ought never to be plucked long after the birds are dead, and, at the latest, before they are quite cold, else they will contract a bad smell, and get matted. Under proper management, and when unmolested by plucking, &c., the tame goose will live to a great age, even, it is alleged, to fourscore years, or perhaps a century. It is, however, seldom permitted to live out its natural life, being sold with the younger ones long before it approaches that period. The old ones are called *cagmags*, and are bought only by novices in market making; for from their toughness they are utterly unfit for the table. The tame goose lays from eight to twelve eggs, and sometimes more, which the careful housewife divides equally among her brood geese when they begin to sit. Those of her stock which lay a second time in the course of the summer, are seldom if ever permitted to have a second hatching; but the eggs are used for household purposes. In some countries the domestic geese require much less care and attendance than in this. Thus, among the villages of the Cossacks, on the Don, they leave their homes in March or April, as soon as the ice breaks up, and the pairs joining, take flight in a body to the remote northern lakes, where they breed and constantly reside during the summer; but on the beginning of winter, the parent birds, with their multiplied

young progeny, all return and divide themselves every flock alighting at the door of the respective place to which it belongs. The accuracy with which they thus return to their several homes denotes more intellect than is generally ascribed to them. Another quality which they eminently possess is vigilance; for nothing can stir in the night but they are roused, and immediately commence cackling; and on the nearer approach of apprehended danger, they set up their shriller and more clamorous cries. Geese are capable of considerable attachment; and some of those attachments are of a peculiar nature, being shown not only to birds and to human beings, but to horses, cows, and other mammalia, and sometimes even to those whose habit it is to prey upon geese.

THE CANADA GOOSE (*A. Canadensis*). This species, which is also called the cravat goose, from its peculiar marking, is larger than the common goose of the eastern continent, though it is not much heavier, and rather a handsomer and better winged bird. Its length exceeds three feet, and the extent of its wings is more than five feet; the bill is two inches and a half long, of a dark colour, nearly black; the irides are dark hazel; the head and neck black, with a crescent-shaped white spot on the upper part of the eyes, which extends on each side of the head as high as the line of the eyes. This is the cravat from which the bird receives one of its names, and it is peculiar to this bird among the whole tribe of the geese. The lower part of the neck, anteriorly, is white; the back, the wing-coverts, and the upper part, generally greyish-brown, with white tips and margins to the feathers; the rump, the tail, and the primary quills, are black; the upper tail-coverts, and also the under ones on the rump, are white; the sides are pale brownish-ash; and the naked parts of the feet, and the webs of the toes, are blackish-ash. There is no difference in the colour of the two sexes, and very little in the size.

This species is the common wild goose of America, and it is as remarkable for its seasonal migrations there as the grey goose is in the eastern continent. In former times the flights of these geese were exceedingly numerous, and extended over the whole of the United States. But the Americans, perhaps copying the wild men of the woods, whom they have displaced, are much more disposed to shoot indiscriminately every wild animal, whether useful or injurious, and, if the former, whether it be or be not in season, than the people of Europe; and the Canadian goose has come in for a share of this work of extirpation.

No accounts have been given of the flight of those birds along the line of the Rocky Mountains, but they are observed on the west side of that ridge, and they are very plentiful to the eastward, their breeding places being in the extensive swamps to the northward of the American lakes, though they extend northward to the very shores of the polar sea. The swamps in this part of America afford, during the summer months, an asylum for marsh and aquatic birds of all descriptions, which it is difficult for man successfully to invade, and from which it is impossible entirely to extirpate their winged and summer-visiting inhabitants. In the summer months there are very extensive districts of this part of America peculiarly adapted as resting-places for aquatic birds, which are, at the same time, quite impracticable for human beings, the time when a passage can be made over them being when they are frozen; and the fur animals are the chief prize of the hunter at that season.

From this species being called the common wild goose in America, and the grey goose being the common wild goose of Europe, it is not very easy to say which of them is meant, when it is stated that the wild goose frequents Spitzbergen and the extreme north of Siberia. There is no doubt, however, that the present species ranges to the extreme north of the American continent. Indeed, if what Pennant records of them be true, their breeding places in America are farther north than any which are regularly inhabited by Europeans, or much frequented by the hunters during the summer. "The English at Hudson's Bay," says Pennant in the Arctic Zoology, "depend greatly on geese, and in favourable years kill three or four thousand, and barrel them up for use. They send out their servants, as well as Indians, to shoot these birds on their passage. It is in vain to pursue them. They therefore form a row of huts, made of boughs, at musket-shot distance from each other, and place them in a line across the vast marshes of the country. Each stand, or hovel, as they are called, is occupied by only a single person. These attend the flight of the birds, and, on their approach, mimic their cackle so well, that the geese will answer, and wheel, and come nearer the stand. The sportsman keeps motionless, and on his knees, with his gun cocked the whole time, and never fires till he has seen the eyes of the geese. He fires as they are going from him, then picks up another gun that lies by him, and discharges that. The geese that he has killed he sets upon sticks, as if alive, to decoy others. He also makes artificial birds for the same purpose. In a good day, for they fly in very uncertain and unequal numbers, a single Indian will kill two hundred. Notwithstanding that every species of goose has a different call, yet the Indians are admirable in their imitations of every one. The autumnal flight lasts from the middle of August to the middle of October. Those which are taken in this season, when the frosts begin, are preserved in their feathers, and left to be frozen for the fresh provisions of the winter stock. The feathers constitute an article of commerce, and are sent to England. The vernal flight of the geese lasts from the middle of April until the middle of May. Their first appearance coincides with the thawing of the swamps, when they are very lean. Their arrival from the south is impatiently attended; it is the harbinger of the spring, and the month named by the Indians the goose moon. They appear usually at their settlements about St. George's day, O.S., and fly northward, to nestle in security. They prefer islands to the continent, as farther from the haunts of man."

This species of goose shows equal disposition to be domesticated as the wild goose of Europe, if, indeed, not greater. It has accordingly been domesticated in many parts of America, and also in England, and various other parts of Europe. The following extract from Wilson will enable the reader to contrast the manners of the Canada goose with those of the wild goose of Europe:—"The flight of the wild geese," says he, "is heavy and laborious, generally in a straight line, or in two lines approximating to a point. In both cases the van is led by an old gander, who, every now and then, pipes his well-known *houk*, as if to ask how they come on; and the *houk* of "all's well" is generally returned by some of the party. Their course is in a straight line, with the exception of the undulations of their flight. When

bewildered in foggy weather, they appear sometimes to be in great distress, flying about in an irregular manner, and for a considerable time, over the same quarter, making a great clamour. On these occasions, should they approach the earth, and alight, which they sometimes do, to rest and recollect themselves, the only hospitality they meet with is death and destruction from a whole neighbourhood, already in arms for their ruin. Wounded geese have, in numerous instances, been completely domesticated, and pair with the tame grey geese. The offspring are said to be larger than either, but the characteristic marks of the wild goose still predominate. The gunners on the sea-shore have long been in the practice of taming the wounded of both sexes, and have sometimes succeeded in getting them to pair and produce. The female always seeks out the most solitary place for her nest, not far from the water. On the approach of every spring, however, these birds discover symptoms of great uneasiness, frequently looking up into the air, and attempting to go off. Some, whose wings have been closely cut, have travelled on foot in a northern direction, and have been found at the distance of several miles from home. They hail every flock that passes overhead, and the salute is sure to be returned by the voyagers, who are only prevented from alighting among them by the presence and habitations of man. The gunners take one or two of these domesticated geese with them to those parts of the marshes over which the wild ones are accustomed to fly, and, concealing themselves within gunshot, wait for a flight, which is no sooner perceived by the decoy-geese than they begin calling aloud until the whole flock approaches so near as to give them an opportunity of discharging two, and sometimes three loaded muskets among it, by which great havoc is made."

It is not very often that this species of goose makes its appearance in England in the wild state. When they do come, they come in considerable numbers, true to their gregarious character, and they come after very severe and long-continued storms, about the depth of winter. On their arrival they are very much exhausted, and easily taken; and cases are mentioned in which a whole flock has been taken alive and shared among the farmers, where they at once associated with the common domesticated geese, and showed no disposition to migrate, or even to escape.

THE SNOW GOOSE (*A. hyperborea*). This is another North American species, and, as the name imports, belongs to the far north of that country. The old and the young have been described as different birds, and in some instances they have been confounded with other geese which appear to have their native locality different. It is to be understood that the native locality of a migrant bird is that in which it nestles, and this one appears to abound nearly round the whole shores of the North Sea, or, at all events, from Hudson's Bay westward to Nova Zembla. It is here worthy of remark, that the longitude of Nova Zembla, which is sixty degrees, or four hours of time east of Greenwich, is the point of division between the two sections of polar migrant birds, just as the North Sea is the counter division, and the average of this, in the polar latitudes, is just about as many degrees of longitude west as the former point is east; so that one-third of the circumference belongs to what may be called the European section, and two-thirds to what may be called the Asiatic and the American.

In the middle latitudes, that is, about fifty degrees north, those sections meet in the Siberian flats, and of course often exchange even aquatic birds with each other; and when any of those birds which do not breed in the north of Europe, or in the islands to the westward, are driven to this country by stress of weather, it is highly probable that, though we are most familiar with them in America, as having possession of the north part of it, they do not come to us from America, but from Siberia.

This division of the birds in longitude upon the eastern continent is a point which deserves attention, as tending to assist in settling the localities of birds in two extensive districts, neither of which it is possible completely to explore. The reason why this is a point of division evidently is, that the mountains of Ural begin at the North Sea, and extend southward for a distance of nearly twelve hundred miles. Those mountains are lofty, their summits are rugged, their sides, or at least their skirts, are covered with pine forests; and thus they form a sort of barrier which no migrant bird, and more especially a goose, is likely to pass. We have no space for entering upon the investigation of this point in the geography of birds; but, as it has not been hitherto mentioned, we place it before our readers, in order that those who are fond of such subjects may turn their attention to it, as being one which is of special importance in any attempt to decide the locality of those rarer migrant birds which severe storms occasionally bring to our island.

We believe that all the heavy birds of long flight, which visit us in winter, and are not absolutely sea-birds, at home and free denizens upon the broad waters, come from Siberia; and we do not think it difficult to show that, without an extraordinary effort, an effort, indeed, for which it is not easy to imagine an adequate physical cause, no such bird could, by possibility, reach England from the extreme north of America by coming south-eastward.

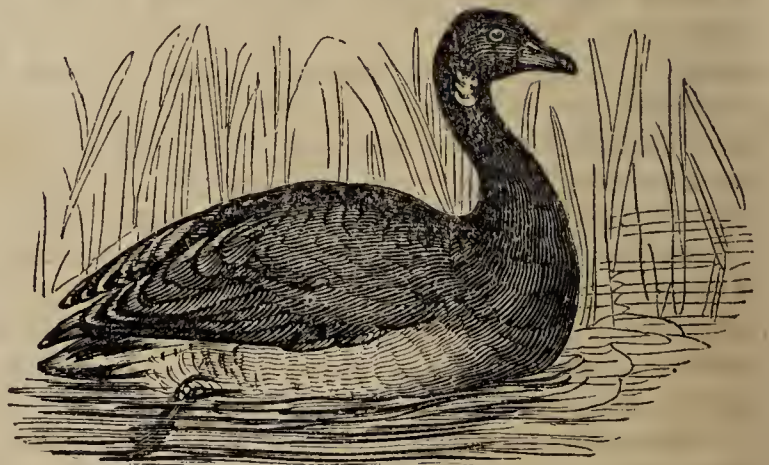
The reason of this is not only worthy of being stated, but it forms a very essential part of the history, in their state of nature, of all the geese which visit the British islands, and the species are not few, and the birds themselves are all valuable.

In the first place, and for a reason which will in part explain why our winter-visiting birds come from the north-east, and not the north-west, we get all our more violent winter storms from the same quarter.

The polar atmosphere, that is, about the latitude of the average north of both continents, is carried eastward by the earth at the rate of about three hundred miles in the hour, while in the middle latitudes of Europe it is carried about six hundred miles eastward at the same time. The consequence is, that, if we suppose a bird to fly south, with the air, of course, as the medium of its flight, it will always have less eastward motion than the air into which it comes; and we need not add, that this deficiency of eastward motion must tell as a westward motion upon the bird. Thus, even granting that there were no storm to drive it westward, a bird would move westward even in attempting to fly southward through the still air; and, as the very same difference of motion in the air is that which brings the storm from the north-east, the storm and the bird very naturally accompany each other. If we suppose a migrant bird to come from the north of America, we have this cause against the probability of its doing so, and to this we may

add the interruption occasioned by the Atlantic. We do not say positively that no birds (we are not speaking of sea birds) come to Europe from America, but the argument is against their doing so, and we are not aware of any physical cause in favour of it. But, to return to the bird under notice:—

The length of the snow goose is about two feet eight inches, and the extent of the wings about five feet: the bill is three inches in length, remarkably thick at the base, and rising high in the forehead, but becomes small and compressed at the extremity, where each mandible is furnished with a whitish rounding nail; the colour of the bill is a purplish carmine; the edges of the two mandibles separate from each other in a singular manner for their whole length, and this gibbosity is occupied by dentated rows resembling teeth, these and the parts adjoining being of a blackish colour; the whole plumage is of a snowy whiteness, with the exception, first, of the fore part of the head all round as far as the eyes, which is of a yellowish rust colour intermixed with white; and, secondly, the two exterior quill-feathers, which are black, shafted with white, and white at the roots; the coverts of these last, and also the bastard wing, are sometimes of a pale ash colour; the legs and feet of the same purplish carmine as the bill; iris dark hazel; the tail is rounded, and consists of sixteen feathers; that and the wings when shut, are nearly of a length. The bill is very singularly formed; the edges of the upper and lower gibbosities have each twenty indentations or strong teeth, on each side, the inside or concavity of the upper mandible has also seven lateral rows of strong projecting teeth: and the tongue, which is horny at the extremity, is armed on each side with thirteen long and sharp bony teeth, placed like those of a saw with their points directed backward: the tongue, turned up and viewed on its lower side, looks very much like a human finger with its nail. This conformation of the mandibles, exposing two rows of teeth, has probably given rise to the epithet laughing, bestowed on one of the varieties. This peculiar structure of the bill is attended with a peculiarity in the feeding of the birds. Their chief food is the roots of reeds and other strong aquatic plants; and they root these up in the marshes in the same way as hogs root up the meadows.



Brent Goose

THE BRENT GOOSE (*A. bernicla*) is a much smaller species than those hitherto described. It measures very little more than two feet in length, and about four and a half in the extent of the wings. Its general colour is brownish, with ash-coloured margins to the feathers. This extends over the upper part, the lower part of the neck and the breast, while the remainder of the under part is dappled with ash

colour and grey. The head and upper part of the neck are black, with the exception of a spot on each side of the neck immediately behind the throat, which is white, as are also the vent-feathers and the upper and under tail-coverts. The lower part of the back and the rump are also black. The tail-feathers, the quills, and also the feet, are dusky. The bill is dark horn colour, narrow and short, not exceeding an inch and a half. The eyes are light hazel, which form a very striking contrast with the black of the head. The most remarkable external character, however, is the white spot on the back of the neck, and next to that the uniformity of the upper plumage. In the females and young birds, the colours are not so well marked, and the neck spots are mottled with dusky.

This is a more discursive bird than the larger geese, being better winged in proportion to its weight, which is only about one half, seldom exceeding five pounds, while the three species previously enumerated may be said to average ten. The brent goose breeds chiefly in the very extreme north. It is found both in the eastern and western continent, and in all probability it ranges round the whole shores of the polar sea, the islands in which are its favourite resting places. It migrates southward in the winter, as far at least as the middle of France; and when the winters are peculiarly severe in the northern countries, brent geese often come in immense flocks, and are very destructive to the wheat fields. Buffon mentions that in 1740 and 1765, which were winters of great severity, brent geese attacked the corn fields in France in such multitudes that the whole inhabitants were raised *en masse*, and had no small labour in driving off and destroying these unwelcome strangers. In mild seasons these birds do not come so numerous as the common wild geese, neither are they so destructive; for, if the marshes are open, they prefer the roots of marsh plants to the *braird* of the wheat fields. We may mention here, as closely connected with the habits of this goose, that the chief attraction of geese to the polar marshes, is not the developed or green vegetation, which appears in those countries during their brief summer, it is the hybernating roots. In those countries the plants, marsh plants especially, work more by roots than by seeds; and though the leaves when they come up are generally coarse, the roots contain a vast accumulation of nutritious matter, far more than those of the larger marsh plants of more temperate countries. This is accumulated as a store for the action of the year, which, under the influence of a never-setting sun, is exceedingly rapid; and the moment that the snow melts and the ice breaks up, the geese are on the grounds, where, by partaking of this rich and abundant supply, they are soon in high condition, notwithstanding their long journey. They breed soon after their arrival, and their broods are out in time to nibble the young leaves of the plants.

BERNACLE GOOSE (*A. leucopsis*). This species of goose is of some celebrity in the annals of fabulous natural history, being the one which was anciently described as being bred not in the common way in which birds are, but growing out of the bernacle shell, which is a well-known pedunculated or stalked molluscous animal, having shells at the extremities of the stalks. Those animals are rooted, and they attach themselves to the bottoms of ships and to floating wood, as they are thereby carried from place to place. There is always a great deal of drift wood

in the North Sea; the storms, while they collect it in some places scatter it to others, so that the pieces float in all directions, and have very often bernacles on the under sides of them. In violent and long continued storms these bernacled logs of wood are frequently cast ashore; and the same circumstances often exhaust the bernacle geese, who do not come southward in very great numbers, unless the storm drives them. Their exhausted or dead bodies are often cast ashore along with the bernacled logs; and thus, at that time, when stories were believed, not in proportion as they were true, but in proportion as they were wonderful, the bernacle shells were set down as producing the geese which came ashore along with them. If this wonderful matter had been confined to the sea-shore, there might have been some plea for it; but several persons have pretended that there were eye-witnesses to the changing of bernacle shells into geese in the larger ponds in some of the middle counties of England, where neither bernacle shell nor bernacle goose is likely ever to be found. There is a satirical allusion to this in Butler's *Hudibras*; but as Butler never was single in his wit, if he could by any means double or treble it, he transferred the strange metamorphosis to the gannet or Solan, *quasi* Solon goose, as a hit at the foolish pretence at wisdom, which he was lashing.

“As bernacles turn Solan geese,
I’ the islands of the Orcades.”

The bernacle goose is still smaller than the brent goose, being less than two feet in length, and only a little more than four in the stretch of the wings; but it is not an unhandsome bird. From the tip to the corner of the gape, the bill is scarcely an inch and a half long, black, and crossed with a pale reddish streak on each side; a narrow black line passes from the bill to the eyes; the irides are brown; the head is small, and, as far as the crown, together with the cheeks and throat, white; the rest of the head and neck, to the breast and shoulders, is black. The upper part of the plumage is prettily marbled or burred with blue grey, black, and white; the feathers of the back are black, edged with white; those of the wing-coverts and scapulars blue grey, bordered with black near their margins, and edged with white; the quills black, edged a little way from the tips with blue grey; the tail-coverts and under parts white; the thighs are marked with dusky lines or spots, and are black near the knees; the tail is black, and five inches and a half long; the feet and legs are dusky, very thick and short, and have a stumpy appearance. This structure of the feet answers well, however, with some of the habits of the bird, as it is much more of a swimmer than most of the geese; and it does not migrate so far or so much inland. It is not uncommon during winter in the Orkney and Shetland islands, where it is called the *clack*, or “claik” goose. This word, which is merely a provincial orthoepy of the common word “clack,” and alludes to the clacking gabble of those geese, has been represented to Baron Cuvier; and he has set it down in the *Règne Animal* as the Scotch name for a goose generally, which it is not. The mistake is a trifling one; but it deserves correction, as Cuvier’s name must carry it far and wide, and preserve it long. It has not been ascertained that the bernacle goose breeds either in the islands or in any part of the north of Scotland, though it has been

ascertained that the brent goose does breed in Sutherland. There is, however, a difference of habit in the two: the brent goose frequents the fields and meadows, and is altogether more inland than this one.

THE BEAN GOOSE (*A. segetum*). This species is the wild goose of the more northerly parts of Britain; and it gets its name, not from any partiality that it has for beans, but from the nail on the tip of its bill bearing some slight resemblance to a small black horse bean. In its general characters it bears a very considerable resemblance to the grey lag, or common wild goose, and, on that account, some naturalists have confounded them. They are distinct species, however, and the bean goose does not come quite so far to the south as the other; though it occasionally makes its appearance in great numbers, which are very destructive to the fields of autumn-sown wheat, which they are very prone to. From the confusion that there has been of this with the other species, it is not very easy to reduce the accounts of them to any thing very precise; and so it may be that in all parts of the British islands this is the most abundant species. That it is in the north is certain; and it has been met with in the extreme south. It breeds in many of the more northerly of the Hebrides; and probably also in Orkney and Shetland, though there are no distinct accounts of the nests in those islands.

The bean goose varies considerably in size; but, generally speaking, it is about two inches shorter, and three or four inches less in extent of wing than the grey goose. The bill is also smaller in proportion, and more compressed towards the tip. It is of a pale flesh colour, or orange, with the exception of the nail, which is black, and which, as has been said, is the foundation of the trivial English name. This black nail is indeed the principal distinction; for, in other respects, excepting size, which is not a character, there is often a great resemblance between this and the other wild goose. Both mandibles of the bill are toothed rather more strongly than in the other. The eyes are hazel or brownish. The head and neck are ashy brown; the whole of the under part, as far back as the legs, is of the same colour, but paler, though on the thighs the colour is deeper. The forehead speckled with white, behind which the feathers are dusky brown. The back is ash-colour; the lower part of the belly, upper, and under tail-coverts white; the scapulars brown ash-colour, edged with white; the greater quill-feathers black; exterior webs grey; secondaries cinereous grey, margined with black on the outer webs. The coverts are grey, excepting the larger ones, which are grey, tipped with white. There appears to be some little variation in the plumage of these birds: in some the bill is of a dull brownish red; the upper part of the back, scapulars, and wing-coverts brown, dashed with cinereous, and tipped with white; greater quills plain dusky black; secondaries grey, tipped and margined with white. On the elbow of the wing there is a callous knob. The windpipe is enlarged about the middle, and its branchings into the lungs are short and inflated. These characters are quite sufficient to distinguish this species from all the others; and there is another character about them which is peculiar, that they are more impatient of restraint, and therefore not so easily tamed. They come to the British islands in the autumn, spread themselves over the country, frequenting the pools on the moors, but dispersing themselves during the day in the fields of

autumn wheat, on which they levy pretty heavy contributions. Their mode of flight is exactly similar to that of the grey geese; and in autumn and early winter numerous flights of them are observed *en chevron* over the middle parts of Scotland. In many districts they remain during the winter in the moorland pools, feeding in the day on the adjoining fields, and retiring to the water at night. In moonlight nights they are a tempting game to the rural sportsman; and as there is no game-law by which a wild goose is protected, they occasion those rustics to pass many a cold and anxious night. They are exceedingly vigilant, so that if there is not some cover between, they see the sportsmen before the sportsmen see them. Hence banks of turf are erected in favourable situations, behind which the shooters lie in wait with long Spanish-barrel guns; but it is doubtful whether the sport is, upon the whole, a profitable one. There is no poaching in the case, however, for poaching is a child of game-laws; and those who shoot bean geese in these places shoot them for themselves or for presents, and not for sale. When wounded in the wing only, they make a bold resistance, and bite almost as sharply as a toothed animal. Their feathers are also exceedingly close; and it is difficult to shoot them effectually, unless in the rear, or when their wings are elevated. Indeed, when obtained, the prize is one of glory rather than of gain to the rustic, for the flesh of the bean goose is more hard and tough, and in every way far inferior to that of the grey.

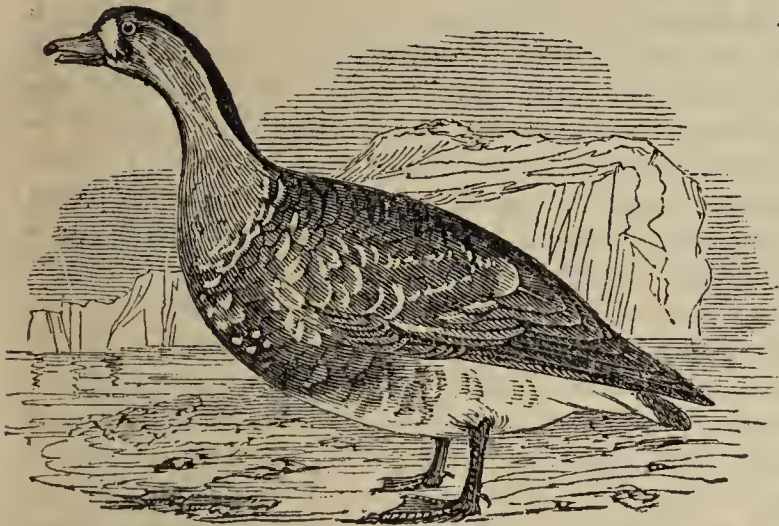
THE WHITE-FRONTED GOOSE (*A. albifrons*). There are some doubts whether this species, which comes to Britain in winter rather as an accidental straggler than as a regular visitant, may not be the young of the snow goose. At least this is the opinion of some of those who have written on the subject. When they come to the British islands they do not attack the corn fields, but confine themselves to the more humid parts of the marshes; and as the small flocks that do make their appearance are generally of one character, the probability is in favour of their being distinct, though they certainly have the same habit in feeding as the snow goose, and are the laughing geese of those who describe British birds.

The length is about two feet four inches, the extent of the wings about four feet and a half, and the weight about five pounds. The bill is thick at the base, of a yellowish red colour, with the nail white. A white patch is extended over the forehead from the base of the bill and corners of the mouth. The rest of the head, neck, and the upper parts of the plumage in some specimens are dark brown, and each feather is margined more or less with that colour; the primary and secondary quills are of the same, but much darker, and the wing-coverts are tinged with ash. The breast and belly are dirty white, barred with irregular patches of very dark brown, and tipped with lighter shades of the same colour. The tail is horny ash-coloured brown, and surrounded with white at the base; the legs yellow.

THE RED-BREASTED GOOSE (*A. ruficollis*). This is unquestionably an eastern species, and in the British islands it occurs only as a straggler. It is one of the most beautiful of the whole genus, both in its figure and in the markings of its plumage. It is above twenty inches in length, and about three feet ten inches in breadth. The bill is short, and of a brown colour; the nail is black; irides yellowish hazel; the cheeks and front dusky, speckled with

white; and there is a white spot occupying the space between the bill and the eyes with a black stripe beneath it, and is bounded above, on each side of the head, by a black line which falls down the hinder part of the neck towards the back; the chin, throat, and crown of the head are also black. Two stripes of white fall down from behind each eye, on the sides of the neck, and meet in the middle; the other parts of the neck and the upper part of the breast deep rusty red, and the latter terminated by two narrow bands of white and black. The back and wings are dusky; the greater coverts edged with grey; sides and lower part of the breast black; belly, upper and under tail-coverts white; legs dusky.

So far as is known, this species of goose belongs only to the eastern portion of those Arctic regions in which this genus of animals have their principal abode, at least we have no distinct account of their occurrence in America. The very few specimens which have hitherto been found in the British islands have been met with on the eastern side, and in the southern parts rather than in the northern. This is of itself sufficient evidence that the birds do not come to America, or from the polar regions of western Europe, but that they find their way across the low countries to the southward of the Baltic.



Red-Breasted Goose.

THE EGYPTIAN GOOSE (*A. Egyptica*). This also is a very beautiful species, resembling in its general form and characters the bernacle and brent geese, though its colours are more brilliant and the turn of the wing is furnished with a small spur. It has been long known in Egypt, and in ancient times it was much venerated in that country on account of the attachment which it has for its young. The ancient Egyptians style it the fox goose, but it is not easy to say for what reason. It has no character in common with any species of fox; and though foxes are particularly fond of all species of geese, it does not appear that they have any more partiality for this one than the rest. It is understood to be rather discursive, and on that account it is with difficulty retained in a domesticated state. It also suffers more from severe cold than any of those species which are natives of the north; and hence we may conclude that it does not in any of its migrations reach the cold latitudes. The length of this species is two feet two inches and five-eighths; breadth four feet four inches; weight six pounds. The bill is of a reddish colour, and, including a protuberance on the base of the upper mandible, is two inches in length; the nail black, nostrils dusky, irides pale yellow; a dark reddish chestnut patch surrounds the eyes and the base of the bill; the

crown of the head and the cheeks are of a dull dirty white, mixed with indistinct spots of rusty brown; the rest of the head, from the nape downwards over the whole neck, is of a dingy chestnut mixed and tipped with a lighter colour. There is a reddish chestnut patch on the breast, the upper part of which, with the shoulders, scapulars, and sides, are pale brownish yellow, beautifully marked or pencilled with dusky waved lines; the lower part is less distinctly marked, and appears of an ash grey colour; the belly white, as also are the wing-coverts; the greater ones are crossed or barred with a black line about half an inch from their tips. The secondary quills are clear reddish chestnut; those of the primaries which join them forming the speculum, which in varied lights are either of a resplendent green or purple; the rest of the first quills, the back, and tail are black; the under coverts of the latter pale chestnut; the legs are long, and, as well as the webs, are of a pale flesh-colour; nails black.

The information which we have with regard to the Egyptian goose in a state of wild nature, is not very clear or satisfactory; but the general assertion is that it ranges in Southern Africa, nearly as far as the Cape. If this is correct, it is an instance of a migratory goose performing all its movements in warm latitudes, and being driven both ways by heat and drought, and never by cold. The rains, in different parts of Africa, occur at different seasons, and as, though the rains are in general heavy when they do come, the drought is so severe and continued, as to burn up the vegetation and dry up the water, such aquatic birds as perform their migrations wholly within that continent, must of course move on y northwards and southwards.

MADAGASCAR GOOSE (*A. Madagascariensis*). This is one of the southern geese, and is a very beautiful bird. The upper parts are blackish with rich green reflections, and there is a large spot of bright sea green colour, surrounded with a black margin, upon each side of the neck; the forehead, the cheeks, the throat, and the under parts are pure white; the lower part of the neck and the flanks mottled with russet and brown; the upper mandible is yellowish; and the under one and also the feet are black. This difference of colour in the two mandibles, is a very decided external mark of distinction in this species from all the rest of the genus. The length of the male bird is nearly three feet and a half; the female is smaller, and the green spots on the neck are obscure or wholly wanting, while the upper part of the body is mottled with grey and brown, and the under part is pale greyish. The young resemble the female.

JAVA GOOSE (*A. Javanensis*). This is also a very handsome species, wholly tropical in its locality, though not confined to the island of Java, but occurring in the other islands of the Sunda group, and also in continental India; but, as is the case with many other animals which are common to these localities, its appearance varies in the different places. The upper part of this species is black, with very rich and brilliant reflections of green; the forehead and top of the head are blackish brown; the neck and the under part are white, lightly spotted with greyish; and there is a broad and well defined gorget of black on the lower part of the breast; the scapular feathers, the flanks and the rump, are finely rayed with black; the quills and tail-feathers are dusky, with a large black spot on the point of the former: the lower tail-coverts are white crossed by a band of black. This

is a small species, not exceeding a foot in length; and it partakes a little of the characters of a duck.

COROMANDEL GOOSE (*A. Coromandeliana*). This is a still smaller species, not being above eleven inches in length, and it is possible that it may be only a climatal variety of the former. The upper part is blackish brown, with faint green reflections; the base of the bill is surrounded with small white feathers; the top of the head is dusky with green reflections; and the back of the neck is spotted with the same colour on a sand-coloured ground; the cheeks, the front of the neck, and the under parts are pure white; the quills are dusky with white tips; the bill is black, and the under sides of the toes dull yellow. Those parts which have green reflections in the male are dusky brown in the female.

THE CHINESE GOOSE (*A. Cygnoides*). This species is not called cygnoides, or swan-like, from any actual resemblance that it has to a swan in any other respect than in colour; and that is not constant, for though it is sometimes entirely white, it is subject to great variety of colour. Though specimens have been brought from China, it is perhaps not very correctly styled the Chinese goose, inasmuch as it is found in many other parts of the south-eastern world, from China to the Cape of Good Hope, and as it is said, from New Zealand, though it does not appear to be met with in New Holland.

Several other species of southern geese are mentioned as being found on the Falkland Islands, on Terra del Fuego, and some other places of the southern lands; there have also been others brought from South America; but all these are too little known, we are too little acquainted with the migrations of birds in the southern hemisphere, and those migrations are in themselves on so small a scale compared with the migrations in the north, that all that could be said about those birds would be little else than a description of colours. There are, however, some other species which require a brief notice, because they deviate in some respects from the typical characters of the genus.

Those species which deviate from the proper character of the geese in many points, but which still essentially retain that character in others, may be divided into two sections: First, those which form a sort of intermediate link between the geese and the swans; and, secondly, those which form a similar link between the geese and the wading birds, more especially the crane family, or perhaps the herons. We shall take them in the order now stated, without being very particular as to the correctness of the names, because though we are not quite satisfied with the existing ones, we do not feel ourselves called upon to contrive new ones, as our object is not to make systems but to give useful information.

THE GAMBIA GOOSE (*A. Gambensis*). This species is originally from the banks of the river Gambia, in Western Africa, and, besides the name which we have given it, it is called the spur-winged goose. It is about the size of the wild goose, but its legs are stronger and longer, and it is, altogether, more of a walking bird. Its bill and feet are of a reddish yellow colour, and the basal part of the upper mandible of the bill is furnished with a double tubercle; the crown of the head and the neck are wood brown; the ear-coverts and sides of the throat are white, mottled with brown; the lower part of the neck, the sides of the breast, and all the upper part, are black in certain

lights, but in other lights the black disappears, and they show the most brilliant iridescent reflections of green and bronze. This rich play of colour is most conspicuous in the scapular feathers and in the quills next the body, but the margins of all the feathers on the upper part partake of the same. The turn of the wing, from the bastard-wing inward to the elbow joint, is white; and on the wrist joint, at the origin of the bastard wing, or the turn of the wing, as it is usually called, there is a strong white spur of a horny texture, inclining upwards and inwards. All the under part of the bird is white. This seems to be a very discursive species; for, though there is no doubt that Western Africa is its western locality, it has been found as an exceedingly rare straggler in the British islands, and a specimen was shot near St. Germans, in Cornwall, in the summer of 1821. The fact of finding a tropical bird, which is not usually a migrant in England, during the summer, is somewhat curious, though it accords with the general habit of birds which do not winter with us, but yet come regularly. Of the habits of this very handsome bird, in its native country, we know little; neither do we know with precision to which of the species of geese that we know better we can connect it with the closest affinity. Probably the Egyptian goose is the nearest, and it also is an African species, remarkable for its beauty, and having a tubercle, though not a spur, on the turn of the wing. This one is usually considered as one of those which have a slight approximation to the swans, but in what this approximation consists, has not been clearly made out. Cuvier, however, places it in that division; and we may remark, that Buffon, Latham, and some others, have confounded it with the Egyptian goose.

THE SWAN GOOSE (*A. Cygnoides*) is certainly intermediate in appearance between the swans and the geese; and it is usually described as a swan, although, as Cuvier mentions, it domesticates, and even breeds with common geese in farm-yards, so that it lives much more upon the land than in the water, and has the habits of the geese, and not those of the swans. It is by no means a rare bird in Western Africa; and it has been, to a considerable extent, domesticated in France. The following is the description of it:—This bird is rather more than three feet in length, and of a size between the swan and the common goose. It is distinguished from others of the goose tribe by its majestic walk and long neck, by having a large knob on the base of the upper mandible, and a skin (almost bare of feathers) hanging down like a pouch or a wattle under the throat; a white line or fillet is extended from the corners of the mouth over the front brow; the base of the bill is orange; irides reddish brown; a dark brown or black stripe runs down the hinder part of the neck from the head to the back; the fore part of the neck and the breast are yellowish brown; the back, and all the upper parts, brownish grey, edged with a lighter colour; the sides, and the feathers which cover the thighs, are clouded with nearly the same colours as the back, and edged with white; the belly white; and the legs are of an orange-colour. These birds, it is said, were found only in Guinea; they are now become pretty common in a wild, as well as a domesticated state, both in warm and cold climates. The female is of inferior size to the male; the head, neck, and breast, are fawn-coloured, the upper part being somewhat paler;

the back, wings, and tail, are dull brown, with pale edges; belly white. In other respects they are similar to the male, but they have a smaller knob over the bill. This very handsome and highly ornamental bird appears to be capable of enduring almost every variety of climate, and of breeding freely in them all; and we do not know, within the whole range of the poultry-yard, a finer ornament than the swan goose. It has been pretty generally introduced by those who attend to ornament as well as to use in their domestic birds; and we believe that it begins to be distributed in the wild state over some parts of Europe.

The birds which seem to connect the geese with the wading birds, but which still retain the principal characters of the goose genus, are southern birds, being found in South America, and still more strikingly marked in Australia. The length to which the present article has extended leaves room to do little else than to mention their names.

THE ORINOCO GOOSE (*A. jubatus*). This species appears to be pretty extensively distributed over South America, and though it has got the name of the Orinoco goose, we believe that it was first discovered in Brazil by Spix. It is of a variegated colour. The head, neck, chest, and vent-feathers, and also a mirror or spot in the wings resembling those in the cheeks, are white. The feathers on the occiput and back of the neck are produced and pointed, giving something the appearance of a mane. The upper part, and also the under part, are reddish; the wings and tail are of a black colour, with violet reflections; and the turn of the wing is furnished with a horny spur, something similar to that on the geese in the corresponding latitudes of Africa. The habits of this species are not very well known, though it is reported to partake as much of the character of a wading bird as of that of a swimming one.

THE HALF-WEBBED GOOSE (*A. semipalmatus*) is a native of New Holland. The upper parts are grey; the head, neck, and thighs, are blackish brown; there is a white collar round the neck, and the upper part of the rump is of the same colour. The length of the bird is about two feet nine. The webs extend only half the length of the toes, and thus it can walk much more easily than those which have the feet completely webbed. It also perches on trees, and in some of its habits approaches to the herons. We have not, however, a very full account of its character in its native locality.

CEREOPSIS. This bird, which has no very definite English name, the colonists of its native Australia not being the best of all nomenclators, ought, perhaps, to range in a separate genus; but still it has a good many characters in common with the geese, and more especially with the one last mentioned. It has the bill short, strong, and covered with a cere or naked skin, extended towards the point, which is arched and truncated. The lower mandible is sloped off at its extremity; the nostrils are very large, pierced in the middle of the bill, and entirely open. Four toes directed to the front palmated with notched membranes. The middle toe is shorter than the tarsus; and the fourth toe, which turns to the front, is furnished with a very large claw. The coverts of the wings are as long as the quills, of which the first is a little shorter than the other; there is a blunt spur on the turn of the wing; and the tail is broad, rounded at the point, and composed of sixteen feathers.

The cere and the naked skin, to the eyes, are yellowish; the principal colour of the plumage is greyish ash, darker on the upper part than on the under. The coverts of the wings are blackish. The quills are dull brown at their tips. The naked parts of the legs, which extend a considerable way above the tarsal joints, are yellowish orange; but the toes and claws are black.

The body of this bird is much shorter than that of the true geese, and is more of a triangular shape, or tapering from the anterior part of the sternum to the tail. The pectoral muscles are large; the windpipe is also large, but of uniform dimensions throughout, and resembling those of the herons and bitterns. The stomach is a true gizzard, indicating that the bird is principally a vegetable feeder. In some of the accounts the head of this bird is represented as being covered with naked skin, but such is not the fact; it has been brought to this country, and we believe that broods have been reared under the management of the Zoological Society of London. Still, however, the characters of the bird, or rather its habits in a state of nature, are but imperfectly understood; and we are still in want of much information respecting it.

There is one structural difference between this bird and the typical geese, in which the two species noticed immediately preceding also agree, and that is the different form of the keel of the sternum. In the geese that part of the bone is not low; but it is of uniform height throughout great part of its length, and nearly straight in its inferior outline; whereas in the species now mentioned, the great development of the sternum is forwards, as if the muscular power of the birds were more accumulated on the immediate organs of flight, and the lower outline is much more curved. In this respect the sternum, which in birds is a most characteristic part of the skeleton, approaches in shape to that of the long-flighted wading birds, the herons, storks, and others of that tribe; and as there is generally a correspondence between the organ and the formation, we may naturally suppose that these birds combine the habits of wading birds with those of geese; and thus they are enabled to summer and winter, without migration, in countries which are subject to great variations in respect of moisture and drought. Too little is known, however, of the habits and movements of the tropical and southern geese for enabling us to speak positively respecting them; and this article has already extended as far as the birds, important as they are, will bear.

GOOSEBERRY, is the well known *Ribes grossularia* of Linnæus. It is found wild in many places in Britain, and has been long cultivated in gardens for its very useful fruit, both green and mature. Of the *Grossularia* or aculeate *Ribes*, there are fifteen or sixteen known species, the fruits of all which are eatable, but the varieties of *R. uva crispa*, are the most valued, and those in most general culture: the rough and smooth gooseberries (*sylvestris* and *sativa*), considered the two chief varieties of *Ribes uva crispa*, are often esteemed distinct species; the former being the *R. grossularia*, and the latter the *R. uva crispa* of Linnæus. De Candolle, however, believes them to be specifically the same.

In Britain, gooseberries are much cultivated, especially in Lancashire, where from prizes being offered by the provincial Horticultural Societies, berries have been produced, each weighing an ounce or an ounce

and a half. Gooseberries, although grown, are not very common in the gardens either of Southern or Northern Europe: the heat of the summers in Spain and Italy being too great, and in Norway and Sweden the seasons are too rapid for the full development of the fruit. In England, as already observed, gooseberries are much esteemed, both as a dessert and kitchen fruit; and the facility with which, when in an unripe state, they can be preserved throughout the year in bottles, from which the air has been excluded by boiling, renders them very servicable as a winter fruit. Gooseberries also, when preserved with sugar, make very good jams and jellies; and, when fermented, an excellent wine is produced, which sparkles when the cork is drawn, and is known as English champagne.

The pleasant acidulous flavour of the gooseberry depends upon the presence of a malic acid blended with sugar; and upon the varied proportions in which these two principles are developed, depends the fitness of the several varieties for dessert or kitchen use, for preserving or for making wine.

The cultivation of the gooseberry is exceedingly simple: young plants are raised from cuttings, taken from the trees in autumn, and planted then or at any time during winter. The cuttings are prepared by trimming off all the buds from the lower part, leaving only four or five at the top to form the future branches. The cuttings should be chosen from the strongest shoots produced from branches, not from the suckers from the root: the bottom and point is cut off, leaving the intermediate part fifteen or eighteen inches long; six or seven inches of the bottom part is inserted into the ground: the like length forms the stem, and the branches issue from the top. Some pains are bestowed to give the branches a right direction to form the future tree. If they rise too erectly they are bent a little horizontally by hooks; if too inclining, they are held up by forked sticks. The branches should be trained first outwards and then upwards, leaving the centre open and rather thin of branches. The summer shoots are produced along the branches, and which are annually pruned down to about an inch at the base. This is the chief culture gooseberry-trees require.

GOOSEFOOT is the *Chenopodium* of Linnæus and other botanists. They are found in all quarters of the globe, though mostly innocuous; some of them have a most offensive scent and flavour, and are used medicinally as anthelmintics; and many of them are used as spinach. The seeds of *C. quinoa*, or petty rice, are used as food in tropical America.

GORYTES (Latreille). A genus of hymenopterous insects, belonging to the section *Aculeata*, and sub-section *Fossores*, and family *Crabronidæ*, having three complete sub-marginal cells, of a squarish form, and of nearly equal size, the second of which receives two recurrent nerves; the mandibles are internally unidentate, and the antennæ are somewhat thickened at the tips. These insects have much the appearance of small wasps, but they are solitary in their habits. Some of the species have the fore legs furnished with spines, and these are supposed to be the constructors of their own nests, whilst others are destitute of these appendages in the female sex, and are, consequently, regarded by M. le Comte de Saint Fargeau as parasitic, and are accordingly considered by this author as belonging to distinct genera, the characters of which he has detailed in a valuable

monograph upon the group, published in the *Annals of the Entomological Society of France*.

GOSSYPIUM (Linnæus). A beautiful and very useful genus of annual and perennial herbs and shrubs, chiefly natives of India. The flowers are monadelphous, and rank in the natural order, *Malvaceæ*. The great commercial importance of the cotton plant, or rather plants, for several of the genus yield cotton, makes its history interesting. In China the *G. religiosum* is chiefly cultivated, it yielding the yellow coloured cotton of which nankeen cloth is made. *G. herbaceum* is cultivated in many parts of the old world as well as in the new. *G. Barbadosense* is a herbaceous annual, extensively cultivated in that and other West India islands. But the plant which affords the finest cotton, cultivated at the Isle of Bourbon, in the East Indies, and in South America, is probably what is called by Roxburgh, *G. obtusifolium*. This is a large, handsome evergreen shrub, much resembling in foliage and manner of growth the Judas tree of our gardens. The plants are put in about eight feet distances from each other, and in regular rows, and the ground is kept clean among them by the hoe. The plant begins to flower very early, or as soon as it is a foot or two high. The flowers are numerous, and followed by capsules, containing the seeds, wrapped in cotton. When the capsules burst the cotton and seeds are liberated, and then collected into baskets by children, who carry them to the warehouse to be, in the first place, freed from seeds, and afterwards packed in bales for sale. The seeds are separated from the cotton by children, by means of a small machine held on the lap. A crank handle, turned with one hand, moves two small metal cylinders, which revolve against each other so closely, that while the cotton, fed in by the other hand, passes through, the seeds are discharged behind.

It appears from parliamentary returns that the annual imports of cotton into this country are much above 227,000,000 lbs. These returns give some idea of the immense value of this plant in the manufacture of whose seed-down there is invested a capital in Great Britain alone of 56,000,000*l.*, giving direct employment to upwards of 830,000 of our population, and being manufactured into goods of the annual value of 36,000,000*l.*

GOURD is the name of the fruit of the *Cucurbita potira* of Linnæus. They are creeping plants, with gross stems, large leaves, and monstrous fruit. Their generic name is given from the circumstance that the shells are formed into various vessels for domestic use, such as bottles, basins, bowls, &c. Many of the species are cultivated as articles of food or drink, or medicine. Some of the bottle gourds (*Lagenaria*) grow to a very large size, forming flasks six feet long, by a foot and a half in circumference; and, when quite young, are made into spoons. The Arabians call the plant *charrah*, and the poorer people often eat the fruit, boiled with vinegar, or fill the shell with rice and meal, and thus make it into a kind of pudding. Some of the bottle gourds have a bitter cathartic pulp, which may be used instead of colocynth; but others, especially the cultivated varieties, have a sweet and esculent flesh. These latter are sometimes called sweet calabashes; but they must not be confounded with the true calabashes, which are species of *Crescentia*.

GRACULA — Grackle. The French ornithologists call birds of this genus *martins*, and with them

there is no impropriety in the name, because they do not call those swallows martins, to which we give that name, and their *martinets* in the swallow family are our swifts, not our martins. In Britain, however, the name martin would be very improperly applied to the genus *Gracula*; because it would immediately suggest the notion of those familiar little birds which build their nuptial bowers with so much industry and ingenuity in the angles of our windows, whereas the genus which we are now very shortly to notice, are very different both in their appearance and their habits.

There are perhaps no birds of which the nomenclature is so confused as those of this genus, as scarcely two of those who have treated of them systematically, have agreed in applying the same name to them. In adopting *Gracula*, we follow Cuvier; but it is doubtful whether his generic characters will apply to all those birds which the continental writers include under the general name of martins. This part of the system is indeed not a little difficult, because the shades of characteristic distinction are very small and exceedingly numerous. In Cuvier's arrangement, the grackles belong to the dentirostral division of *Passeres*; and he arranges them near the choughs. They are all birds of omnivorous habits, though the principal food of very many of them consists of locusts and grasshoppers, in the destruction of the former of which they render important services to those countries in which they are found. The greater number are natives of the grand head quarters of the more splendid birds of omnivorous character; namely, the oriental Archipelago and the Oceanic isles; but some of them are found in the east and south-east of Asia, others probably in Africa, and certainly in Madagascar; and there is at least one species which comes periodically into eastern and central Europe, and in very rare instances makes a dash over into the British isles.

They resemble various other genera of the same part of the system. They have been classed in part at least with the thrushes, but they less resemble these than they do some others. If we consider them in respect of their food, they come perhaps nearest to the ant-eaters; and if we have reference to their general habits, they bear no inconsiderable resemblance to the starlings: like these last mentioned birds they are gregarious, appearing in numerous flocks; and it is this part of their habit which renders them so valuable in destroying the countless hosts of the locusts.

The generic characters are: the bill conical, and much lengthened, without any cere at the base, and with a slight notch at the tip of the upper mandible; both mandibles very much compressed, with sharp cutting edges, and a little arched, the nostrils oval at the base of the bill, and partly covered by a feathered membrane; the feet have four toes, the middle front one shorter than the tarsus, and united to the outer one at the base; the first quill of the wings merely rudimental, and the second and third the longest in the wing.

In their manners they are very familiar birds, little afraid of the immediate presence of human beings, and not much of the discharge of musketry. Indeed they will alight and feed in the fields, in the very middle of the people that are at work there, and pursue their useful labours as if they were fellow-workers with man. Their food is by no means confined to locusts, but extends to all the larger species of insects, which are so destructive to the produce of

the fields in the warmer regions of the world. The young are very easily tamed, and readily taught to repeat words; indeed when domesticated and kept in the farm yard, they imitate the cries not only of all the kinds of domestic poultry, but of sheep, goats, and almost of every other animal of which they hear the voice. It is probably in consequence of this familiarity in the manners of at least one of the species, that Temminck gave them the generic name of *pastor*, by which the only one occasionally visiting this country is generally known. The species are numerous; but our limits will admit only of mentioning one or two, which plan we must follow in the case of all the omnivorous birds of the same country which the grackles inhabit.

COMMON GRACKLE (*G. tristis*). How this bird came to be called *tristis*, "the sad," it is not easy to say; for in truth it is about as lively a bird as any of which we are acquainted. The usual length is about ten inches. The upper part marron brown; top of the head furnished with long black thread-shaped feathers; a triangular naked patch behind the eye; the principal quills black at the points and white at the bases; the tail-feathers brown, with the outer webs of the lateral ones white toward the extremities; the throat, neck, and upper part of the breast, deep grey, the rest of the under part dull white; and the bill and feet yellow. This species is very generally distributed, both through continental India and through the islands; and it is as serviceable in destroying those insects which attack vegetation above ground in those countries, as the common rook is for destroying the under-ground depredators of our fields; and where the inhabitants, inattentive to the uses of birds, have been inconsiderate enough to seek to exterminate the grackle, the same consequences have followed as when the same inconsideration in our own country has led to the destruction of the rook. When our rooks have been thus destroyed, the under ground swarms of coleopterous larvæ have cut off both corn and grass, at half an inch depth below the surface, so that in brief space hundreds of acres were perfectly bare; and just in the same manner the destruction of the grackles, and birds of their class, has been almost instantly followed by a desolating flood of locusts, which left behind them no green thing.

In the islands of Bourbon and Mauritius, these birds are held in the highest estimation. In former times, the produce of the fields was in the progress of being destroyed by locusts, the eggs of which, previously unknown in the island of Bourbon, were introduced with some plants from Madagascar, and they bred so rapidly, that the whole island was threatened with desolation. Poivre, the then governor, to whose science and patriotism the island owed so much, learning the great services which these birds performed in India, had a number of pairs introduced and distributed over the islands. They bred very fast, were diligent in their labours; and in a few years the locusts seemed extirpated. When this took place the grackles began to dig and examine the newly sown fields; and the colonists, concluding that they did so for the purpose of eating the seeds, used every means to exterminate them, and soon succeeded. They, however, had reason speedily to repent, for no sooner were the grackles destroyed, than the ravages of the locusts began. Upon this a second importation took place, and in order to prevent a recurrence of their former folly, special laws were enacted for their

protection. They soon again cleared the island of locusts, and also the coffee plantations of those grubs which are so injurious to them. They next proceeded to attack the corn fields and orchards, and even to kill the young of pigeons and other domestic birds. This shows how rapidly they multiply; and the consequence was, the enactment of a sort of Malthusian law, for a positive check to prevent their numbers from exceeding the quantity of their legitimate food; and thus regulated, we believe, they did good without any admixture of evil.

PAGODA GRACKLE (*G. pagodarum*). This species is very plentiful in most parts of India, and has obtained its trivial name from perching on the temples. It is bluish-ash on the upper part, clouded with fawn colour toward the extremities of the wing-coverts. The top of the head and neck are furnished with long and silky feathers, of a black colour, with bronze reflections; but the shorter feathers on the head are buff colour variegated with white. The quills are black with bronze tips; and the tail-feathers bronze colour with white tips. The under part is buff with paler margins to the feathers. The under sides of the wings are white clouded with ash colour; and the base of the bill is black, but the greater part of the length of it, and also the feet, are yellow. The length is about eight inches.

ROSY GRACKLE (*G. roseus*). This species is much more discursive than any of the others; and as such it has been long known in the ornithology of Southern Europe. It used to be considered as a thrush, and was styled the rose-coloured thrush, by the earlier describers, while Selby, and some of the later ones, taking up the name given by Temminck, have called it the rose-coloured pastor. Its generic characters are, however, those of the grackles. It is about the size of the starling, that is, about eight inches long. The head, which is furnished with a large and handsome crest, is of a black colour, and so are the neck, the wings, and the tail; and all the rest is of a rosy tint, or rather something between peach blossom and salmon colour. The wing-coverts are inclining to brown with rich metallic reflections; and the feathers on the head, the crest, and the neck, are velvety in their texture, but with obscure reflections of purple and green. The female has the crest shorter, and the whole body inclining more to brownish grey. The young are brown mottled with grey; their legs are also brown, whereas the legs of the full grown birds are of a reddish colour. These birds come into Europe only in the summer; but they are exceedingly active and voracious, destroying vast numbers of the larvæ of the larger insects. They come along with the orioles, fly-catchers, and other birds which migrate from central Asia, as the ground there gets dried and parched by the ardours of the summer's sun. In general, those summer birds which migrate in longitude rather than in latitude, and come westward approaching the central heights of Europe in greater or smaller numbers, according to the character of the season, do not reach beyond those heights, excepting as stragglers; but they are all birds of powerful wing, and sometimes find their way to Britain. It is worthy of remark that, while our regular summer visitants, which come in numbers, have their localities, in which they are often very abundant, though quite unknown out of them, the stragglers, which come but rarely, come indefinitely to all parts of the islands, plainly showing that the birds are not, in any sense of

the word, "at home" with us, but are without the locality of their proper instincts, and therefore unable to select the places of their resort. These birds are handsome and beautiful; and when one happens to alight in the country, it is eagerly sought after as a prize of no ordinary value.

WHITE-EARED GRACKLE (*G. auricularis*). Upper parts rich bronze colour; head, neck, throat, upper part of the breast and coverts of the wings brilliant black; the top of the head furnished with long and silky feathers; a flesh-coloured naked space surrounding the eye; the ear-coverts white; the rump and under part pure white; the bill and feet yellow. This species is about eight inches long, and is found in some parts of India, but more abundantly in the oriental isles.

CRESTED GRACKLE OF CHINA (*G. cristatella*), has the whole plumage of a dull bluish black, with the exception of the tail-feathers and the quills, which have some white, the primary quills at their bases and the other quills at their tips. The head is furnished with a crest of long black feathers; and the bill and feet are yellow. This species is about eight inches and a half in length. It is found in the east of Asia and the isles.

SILKY GRACKLE (*G. sericeus*). This is a small species about seven inches in length. The upper parts are ash-coloured, with the coverts and quills black at the points and white at the bases. The head is yellowish white, almost yellow on the crown; the upper part of the neck yellow, and the under parts greyish white; the bill is purple red, and the feet reddish yellow. In the female the quills and coverts are brown, the top of the head black, and the forehead mottled with brown and white, which is also the colour of the flanks; the bill and feet are brown. In consequence of this, the two sexes have been sometimes described as different species.

There are various other species or varieties in the genus, but as they differ little in their habits, a description of them would be merely one of colour, and have no general interest.

GRAINS OF PARADISE is the *Amomum grana Paradisi* of Willdenow. These grains are stomachic and stimulant, but far less grateful as a spice than either cardamoms or ginger; they are often, however, substituted for the former, and have even been called the greater cardamom. The officinal cardamom is the fruit of the *Alpinia cardamomum*.

GRAMINEÆ. A truly natural order of plants, and one in which a very general resemblance obtains. According to London's Hortus Britannicus, this order contains one hundred and fifty-eight genera, and one thousand and seventy-one species. For the facility of studying this extensive family of plants, it has been divided into sub-orders, sections, and divisions; but, notwithstanding this, long and intense study is required to enable a student to become an accurate practical gramineæst.

It is hardly necessary to add, that the grasses are directly and indirectly the most valuable of all other tribes of plants for the use of man. To offer proofs of this would be to write histories of pastures, fodder, cattle, bread, corn, &c. &c., a knowledge of which is contemporaneous with our very being. All the principal and most useful species may be found described under their proper names.

GRANATEÆ. A small natural order, containing at present only one genus, **POMEGRANATE**, which see.

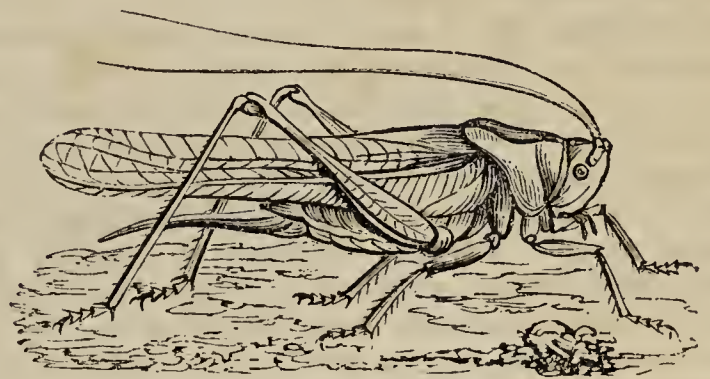
GRAPE. The fruit of the cultivated vine, so well known as to need no description. For the cultivation see article VINE.

GRAPE HYACINTH is the *Muscari* of Desfontaine, and the *Hyacinthus muscari* of Linnæus, a common flower-border bulb.

GRAPSUS (Lamarck). A genus of crustaceous animals belonging to the *Decapoda Brachyura*, and to the section *Quadrilateres* of Latreille, having the shell or carapax nearly square, the legs flat, the eyes placed upon short foot-stalks at the anterior angles of the shell, and the antennæ covered by the front of the latter. The abdomen is seven-jointed in both sexes. These crabs, of which many species are described, are, with a single exception, inhabitants of the seas of the East and West Indies. At Cayenne they are called *ragabeumba*, that is, soldiers. During the day they hide themselves under stones and other bodies in the sea; some, however, frequent rivers subject to the tide, but these generally are found upon the moist banks out of the water. It is said that they even climb up the trunks of trees, and seek refuge beneath the bark. They assemble in considerable numbers, and at the approach of danger retire to the water, striking their claws against each other with violence during their retreat. The only European species is the *Grapsus marmoratus* of Fabricius, which is found upon the coasts of France and England.

GRASSHOPPER. The ordinary name given to an extensive group of insects, forming portions of the great Linnæan genus, *Gryllus* (which see), and distinguished by the power which they possess of leaping to a considerable distance. In our article upon the *Cercopidæ*, we have entered at some length into the various saltatorial powers possessed by insects, and have shown that in the greater number it is to the peculiar construction of the hind legs that they are indebted for such powers. In the insects now under consideration this is particularly the case, and as they are abundant in the summer and autumn months in every field and upon every bank, no insects are more easily discovered, owing to their perpetual chirping, nor are any more capable of showing the beautiful mechanism with which the motions of the insect world are provided than these. For rapid motion through the air with closed wings, it is proper that the body of an insect should present in its form as little resistance as possible; we find, therefore, the body of the grasshopper long and compressed. But it is the instruments by which this motion is imparted to the insect which now especially merit our attention. These are the hind legs, which are attached to the body, nearly in the centre, at the sides, by means of very powerful muscles, and which, instead of being short and formed for laying hold of objects, like the four anterior and intermediate legs, are longer than the entire body, and seem, when the insect is merely creeping about, to be dragged along without assisting in progression. The thigh is the strongest part of the legs, its basal portion being the thickest, and it gradually becomes more slender to the tip. Along its outer surface there are several ridges, which must evidently impart considerable strength to the limb, and the space between these ridges is likewise ornamented with oblique ridges, which give it a beautiful appearance. On looking at the limb from behind, a depressed space is observed along its entire length, margined on each side with strong spines, of which we shall subsequently notice

the use; the shank is more cylindric and slender than the thigh, smooth internally, but generally spined on its outer edge, and armed at its extremity with several very strong short spurs. This part of the limb is of the same length as the thigh, and is terminated by a short jointed tarsus, having two strong claws at the tip. We will now suppose the insect creeping upon the ground, and suddenly menaced by the approach of danger. For the avoidance of this danger it is necessary that a sudden spring should be made, and it is also necessary that for doing this the body should be thrown *upwards* in a greater or less angle, according to the distance to be gained. Now this is effected in a very peculiar and interesting manner; the thigh, in its ordinary position, is placed at an obtuse angle with the front part of the body, and the tarsus is placed at an obtuse angle with the shank; thus:



Great Green Grasshopper.

the tip of the shank or tibia is then suddenly brought into contact with the base of the thigh, being retained in its position during the subsequent stroke by means of the spines upon the margins of the hinder edge of the thigh; but the tarsus is, during this operation, kept in an horizontal position; the obtuse angle, therefore, between it and the external extremity of the shank becomes, by degrees, a right angle and then an acute angle; the more the thigh is lowered the more acute being the angle between the tibia and tarsus; by this means the strong spurs at the extremity of the tibia are fully exposed and brought into action, being now, in fact, the support of the hind part of the body, and offering a very firm point upon the plane of position. A violent stroke is then made by the muscles of the hind thighs, the body is prevented from moving in a backward direction by the spurs of the tibia, and the body is accordingly propelled forwards and upwards, in proportion to the angle made by the tarsus and the tip of the tibia. But the grasshopper is often assisted in its motions by other organs, for no sooner is it in the air than it expands a pair of wings of a delicate gauzy texture, which had been previously folded up by means of many longitudinal wing-ribs, arranged like the ribs of a fan, beneath a pair of narrow wing-covers, often elegantly marked and coloured. We have been thus particular in explaining the mode by which the leaping of the grasshopper is effected, having only met with a short and insufficient explanation of it in the works of writers upon popular entomology.

We have said that the grasshopper is easy to be traced, from the chirping noise which it makes, but it is necessary to notice that it is only by one sex, the males, that this noise is produced. The same peculiarity also exists in the not less noisy *Cicadæ* (which see), although the apparatus by which the sound is pro-

duced is quite distinct. In the house and field cricket (see the article CRICKET), which are very nearly related to the grasshoppers, both forming, in fact, portions of the genus *Gryllus* of Linnæus, we have noticed the structure of the wing-covers, and in those species of grasshoppers, which have long and slender antennæ, the structure is very similar. De Geer, speaking of the great green *Gryllus viridissimus*, which is common near London, thus describes the structure as well as the mode in which the sound is produced:—"In that part of the right wing-cover of the male, which is folded horizontally over the trunk, there is a round plate, made of very fine transparent membrane, resembling a little mirror or piece of tale, of the tension of a drum. This membrane is surrounded by a strong and prominent nervure, and is concealed under the fold of the left wing-cover, which has also several prominent nervures answering to the margin of the membrane or ocellus. There is every reason to believe that the brisk movement with which the grasshopper rubs these nervures against each other, produces a vibration in the membrane augmenting the sound. The males in question sing continually in the hedges and trees during the months of July and August, especially towards sunset and part of the night. On approaching them they immediately cease their song." But the majority of English grasshoppers belong to a distinct section, having short and rather thick antennæ (and belonging to the same division as the locust), and in these the chirping is produced in a different manner, the thighs being rubbed alternately briskly against the closed wing-covers, which causes the regular breaks in the chirping; moreover, near the base of the hind legs, De Geer discovered a cavity partially covered by membrane, having a semi-circular aperture, which must evidently contribute in a considerable degree to produce and augment the sound.

The larvæ and pupæ states of these insects are very similar in form to that of the imago, the former being destitute of wings, and the pupæ having only rudimentary wings and wing-covers; hence, although in these states they are able to leap to as great a distance as when winged, they are incapable of chirping.

GREBE (*Podiceps*). A genus of *Palmipede*, or web-footed birds, belonging to Cuvier's family of divers, or short-winged birds, and placed as the first of that family in his arrangement. They are very peculiar birds in their structure and habits, and on that account they are highly interesting. They are, in one respect, the first of the aquatic birds; but they do not take up the connexion from the birds with sentient bills, whereof the avocet is the last. They take it up more from the herons, which find their prey by wading in the shallows, and seizing it in the free waters by means of a hard, firm, and sharp-pointed bill, which they can use with great precision.

The grebes seize the principal part of their food in a similar manner, only they have the power of committing themselves to the water, and seizing the prey when they are under the surface, and often at the depth of a good many feet. For this purpose they are admirably adapted, not only in the form and action of their organs of motion and prehension, but in the general form of their bodies, and in the texture of the feathers with which they are covered.

As the grebes take up the character where it is left off by the herons and those other birds which, wading but not swimming, capture their prey in the waters,

by a firm bill directed with very certain aim, so they transfer it to the sea divers properly so called, to those birds which subsist by following their prey under the surface in the free range of the oceanic waters.

The grebes are not, however, sea birds, though they can upon emergency make their way in salt water. They are inhabitants of the smaller lakes and ponds, especially those which are tangled with plants; and they are admirably fitted for making their way under water in such places. We must, however, mention the generic characters before we proceed farther with the general description.

The bill is of mean length, though generally longer than the head; it is straight, conical, and compressed or cylindrical in its section. The upper mandible is awl-shaped, and abruptly curved toward the point. The nostrils are lateral, and pierced in the middle of the length of the bill; oblong and open externally, but capable of being firmly closed internally by a membrane; and they have a communication the one with the other. The feet are articulated far backwards; the tarsi are very much compressed, and have membranous margins. There are four toes on each foot, three to the front and one to the rear; these toes are margined by broad and very peculiar membranes, which are, however, divided down nearly to the articulations; and it is on this account that the name of *Podiceps*, or "divided foot," is given to the genus. Of these toes the external one is the longest; and the fourth, or hind toe, is very compressed, bordered with membrane, articulated rather upon the inner side of the tarsus and touches with the point only when the foot of the bird is on the ground.

From this form of the feet, their distance laterally from each other, and the oblique motions of the joints both of the tibiæ and the tarsi, the grebes are very clumsy and imperfect walkers. Their legs are articulated far behind the centre of gravity of the body, and thus they are unable to support it in a horizontal position, or any thing approaching to it. Those who think of no other use or office in a foot than that of walking upon the solid earth, would be apt to regard the foot of a grebe as the most unformed and awkward of all organs with which any animal could be furnished; but when we come to consider the use which the grebes make of this apparently awkward foot in the most important operations which they have to perform, we at once see that there is not in the whole range of the animal kingdom, wide and varied as it is, a finer instrument than the foot of the grebe. No human knowledge of the principles of mechanics could contrive such an instrument, and no human dexterity could form it, even though in possession of the plan. Oars and paddles, and other implements for the moving of boats and other craft through the waters, have been made of various forms and used with different degrees of effect in proportion to the power necessary for putting them in motion. Among them all, however, there is nothing which can be at all compared with the foot of the grebe, even if we leave its self-motion out of the question, and look upon it merely as a mechanical instrument. When the bird is under water (and it is rarely a surface swimmer) the foot is both oar and rudder. In giving the stroke which impels the body forward, the foot acts with the maximum of power in the direction which gives the power the maximum of effect. In

recovering the foot, that is in bringing it in advance through the water preparatory for a second stroke, the mechanism performs its office with equal perfection. When the full bent of the stroke is given, all the joints and membranes of the foot are at their greatest degree of tension, so that the foot strikes as if it were one expansion of solid matter, and the membranous border of the tarsus, together with the flat surface of the bone, assist in giving additional effect. As soon, however, as the stroke is given the whole foot relaxes, the tarsus turns with its thin edge to the front, and thus the foot is advanced and a new impulse given before the momentum of the body is visibly diminished. No feathering of an oar, even by a most expert rower, can at all compare with this recovering of the grebe's foot, though that manœuvre with the oar is a sort of humble imitation.

Grebes being chiefly inhabitants of those waters in which there is a good deal of vegetation, derive considerable advantage from the division of the foot, and they get additional power from the great length of the toe. The wings also keep stroke with the feet; and from their hollow shape and their firm texture, they may assist a little in the forward motion, yet the chief use of them is in directing the course of the bird, especially in ascent and descent; so that, thus furnished, the grebe has nearly the same command of itself in the water of the tangled pools as the divers have in the free water of the ocean.

The form, the covering, and indeed every thing connected with these birds, is a beautiful instance of the adaptation of structure to habit. No plumage resists the water better, or gets through it with less friction. Indeed the surface of the grebes is strongly repellant of water when they are alive; and though it is not easy to say in what this property of the feathers of birds which swim under water consists, the knowledge of it would be exceedingly useful in determining by what means, other than mere form and smoothness of surface, a vessel could be propelled through the water. The grebes afford a very convincing proof that this property is not obtained by the application to the feathers of an oil secreted by the glands on the rump of birds; but that, on the other hand, it must extend to the whole surface, to every feather, down even to the finest filaments of the webs. That it is something connected with life in the birds we are certain, because the dead feathers of those birds are soon wetted; and that it is not put on by any action of the bill, because it is just as perfect in those parts which the bird cannot reach with its bill as in those which it can reach.

There is another provision in the covering of the grebes which shows how well they are organised for bearing the temperature, as well as the other influence of the water. They are covered immediately under the skin with a considerable layer of fat; and that fat is of the same oily nature as the fat on the under sides of many swimming birds, and also on the bodies of whales. This fat gives a disagreeable rancid, or what is usually termed "a fishy flavour" to the flesh of grebes; but it is possible that, as is the case with many of the marine birds, this flavour might be, in great part at least, removed by burying for some time in fresh mould. This flavour appears to be a subject respecting which there are very general mistakes. The term "fishy" seems to be a misnomer, for it is not easy to see how feeding upon fish could communicate this flavour; because it is the flavour of a

substance which has undergone two complete changes, first, assimilation by the digestive process, and secondly, secretion by those tissues in which it is lodged. The way in which the particular nature of the food of animals modifies the qualities of their flesh is, however, a subject upon which much information is wanted before any definite conclusions are arrived at.

These birds are very miscellaneous feeders. They do catch fish, but their bills are not adapted for the capture of very large fishes; and they are known to feed on many other substances, such as spawn, water beetles, crustaceous and molluscous animals; and it has been alleged that they sometimes eat the more succulent roots of vegetables, though this is somewhat doubtful. They also swallow their own feathers, which they are careful to pull out the moment that they begin to decay; and as these feathers, mixed with the elytra of beetles, and other indigestible matters, are often found in pellets in their stomachs, it has been supposed that they "cast" these pellets in the same manner as owls and other birds of prey cast the indigestible "quids" of their food.

From their structure, grebes are very awkward upon the land; and therefore they come ashore as seldom as possible, and they are comparatively seldom on the wing. At those seasons when they have recourse to the sea, and the wind blows strongly in shore, they, like the other diving birds, have considerable labour in keeping themselves from being strangled, which they endeavour to do by swimming to windward. But though these are times of labour to them, they are also times of plenty; for the agitation of the water brings up a great quantity of those substances on which they feed, and so tosses about the smaller fishes that they also become an easy prey.

The nesting-places of grebes depend a good deal on the nature of their pastures; those which are more seaward, or inhabit waters destitute of vegetation, nestle in holes of the banks; whereas those which frequent the reedy and sedgy pools inland form their nests of vegetable substances, concealed in a tuft near the water's edge, and not unfrequently over its surface, if the standing vegetation is capable of supporting the nest. Those nests consist of a great bunch of vegetable matters, but, as the whole of these are the produce of the waters, they are much coarser than the nests of those birds which seek their materials on land. The nests of grebes are sometimes flooded, and the wind sometimes breaks them from their moorings, and drifts them to other places of the pools, without having sustained much injury. On these accounts there have been many mistakes respecting those nests. It has, for instance, been said, that they are purposely wetted, and that the fermentation produced by the humidity of such a mass of vegetable matter generates heat, which greatly assists in hatching the eggs. Now, this mistake, which is a very common one, involves two errors; one, in the physiology of warm-blooded animals, and a still greater one in the physiology of plants, or rather, perhaps, in the phenomena of decaying or decayed vegetable matter. So far as we know, there is no egg of a warm-blooded animal that can be quickened into life by any action of heat, if accompanied with moisture at the same time; and, on the other hand, the vegetables which grebes, and all other birds which use vegetables, construct their nests of, are past that state in which any moistening of them would produce either heat or fermentation.

There must be sap in vegetables, in order that either of those operations may take place, for a sapless vegetable merely dissolves mechanically in the water by maceration.

The other mistake is, that of supposing that grebes have forethought purpose, and thus build their nests so as to rise and fall with those waters which are subject to differences of level; that, in some circumstances, the heavy nest of a grebe, when placed so as to touch the surface of the water, may descend if the water is lower; and, as the weight is in the great volume, and not in the specific gravity of the dry leaves and stems, it is just as likely that such a nest will be raised by an elevation of the water; but that the grebe has any forethought purpose in this, is just as absurd as it would be to suppose that a grebe should go and examine whether a pond had a sluice to it or not, before beginning to build her nest; and not only this, but, before she could do what is said of her by purpose and contrivance, she would require a good deal of topographical knowledge; for the characters of the surrounding country, and that to a distance far exceeding any grebe's journey, very frequently determines whether the surface of a pool or lake shall be constant or variable.

We shall now give a short glance at some of the species of grebes; and, as they resemble each other very much in their habits, we shall make our remarks brief.

RED NECKED GREBE (*Podiceps rubricollis*). In the British islands this species is not very common, and we believe it has not been seen excepting in the winter. Still this circumstance does not warrant us in saying positively that it is a migrant, because grebes are not much on land at any time, and there is much more concealment for them upon the waters in summer than in winter. Besides, all our pool-breeding birds seek toward the cold and upland pools in the summer, because those pools are not so liable to be dried up as those in the warmer, more cultivated, and more thickly inhabited parts of the country. This is a species of the same instinct which brings the warblers to our groves, and sends the wild geese to the polar regions; but, when we have stated that it is an instinct, we have stated the ultimate point which our knowledge reaches, and can assign no reason why it is such.

Besides being rather rarer than most of the other grebes, this one is a more clumsy and heavy bird, and not so handsome as the smaller species. Its length is nearly a foot and a half, and its weight about a pound and a half; the bill is the same length with the head, black for the greater part of the length, but yellowish at the base. The crest on the hind head is very short, and there are no rough or long feathers on the sides of the head. This structure would lead us to suppose that this bird is less expert in using its bill in the waters than the crested ones, because almost all birds that seize their prey rapidly in the free waters, whether their bodies happen to be immersed in the waters or not, have a crest on the hind head, which appears to guide the bill in the same manner as a dart or arrow is guided by the feathers. The upper parts are of a brownish black colour, but the secondary quills and basal part of the primaries are white. The cheeks and throat are of a grey colour; the breast reddish chestnut; and all the rest of the under part white, with a fine silky gloss. Indeed, the under parts of grebes are so glossy,

so finely feathered, and so durable, that they are often prepared and used in the same manner as furs. The female differs little in plumage from the male, but the young do not acquire the red colour on the breast till after the second moult. The time of moulting in this, and indeed in all the species, is the autumn; and, so far as has been observed, there is very little difference in the summer and winter plumage. Indeed, as grebes are almost constantly in the water, and thus subject to much less variation of temperature than land birds, their differences of season are also less. Though, as already stated, these birds have not been seen, except in winter, analogy would lead us to conclude that they do breed somewhere within our shores, for we are acquainted with no species of grebe which is known to be migrant, and there are no genera of birds, so well defined and so peculiar as the grebes are, of which some species are migratory and others not. In many parts of the world, where lakes and marshy pools are better adapted to its habits, and more retired and solitary, this grebe is more plentiful than in the British islands; and there is reason to believe that it is resident all the year round in most, if not all, of those places, though there it is little observed during the summer.

THE CRESTED GREBE (*P. cristatus*), though more common and frequently seen than the red-necked species, is yet by no means a common bird in the British islands, and, in consequence of the drainage of many of the upland pools, it is not nearly so common at the present time as it was formerly. On the continent of Europe, and in some parts of Asia, it is far more frequently met with, though its habits unfit it for those countries which are burnt up by drought in the summer months. It must be understood, however, that, though an aquatic bird, it is not a fen bird, and therefore it is met with most abundantly in the upland pools of the midland counties, where the waters divide and run to the opposite seas. It is more aquatic than the red-necked species, or, at all events, it frequents broader waters, where it is more easily seen; and there are few of the large lakes in any part of the temperate latitudes of the eastern continent where it is not to be met with. Grebes resembling this, and perhaps originally of the same stock, though partially altered by climate, are also met with in America; but the waters in North America cover such an extensive surface, that the exploring of them is no easy task, and therefore we are ignorant of the numbers and the manners of many of their habits.

This species, though handsome in its form, and not apparently so thick and heavy as the former, is a much larger and weightier bird. It measures about one foot nine inches in length, and two feet and a half in the stretch of the wings, and weighs from two to three pounds. The bill is about two inches and a half in length, which is more than the length of the head; and the colour is dull red on the basal part, and pale yellowish brown on the middle of the upper mandible and the tip; the legs and feet are dusky black, with a yellowish tint on the inner surfaces of the tarsi; the irides, and naked skin round the eyes, are bright crimson, and so is a stripe of naked skin during the breeding season, which extends from the opening of the bill to the eye; at other seasons this stripe is lead-coloured, and the tint of the circle round the eye fades; the crest is divided into two rounded lobes, and the ear-coverts

are produced, and form a sort of short ruff or mantle on the upper part of the neck; the crest and top of the head are dusky black, the cheeks are white, with the exception of a dusky streak extending from the eye to the crest; and the ear-tufts are rust-coloured, with deep black margins; the general colour of the upper part is dusky brown, with the exception of the secondary quills, and a small portion at the turn or wrist of the wing, which are white; the chin also is dusky brown; but all the rest of the under part is pure white, of exquisite texture and gloss, so that the skin of this species is highly prized for ornamental purposes. The female is rather smaller than the male, and has the crest shorter, and the colours on the upper part paler. The young, in their first plumage, are without the crest and the tufts, and have waving lines of brown on the sides of the head.

The nest is formed as near the water as possible, and generally on the side of some tufted island most remote from the land. It consists of a great quantity of herbage, and contains four eggs, of nearly the same size as those of a common pigeon; when first laid those eggs are white, but they are very soon soiled by the mire, which adheres to the feet of the parent bird when she goes into the water to feed, and also as she waddles across any sludge that may be between the water and the nest.

Crested grebes are very industrious birds, and capture great numbers of small fishes and other inhabitants of the waters. They are said to be especially partial to young eels, which form great part of the food of the young while in the nest. The slow and wriggling motion of those eels naturally render them a more easy prey to the grebes than the fishes of greater activity are. These birds are not very often seen, and it is exceedingly difficult to procure specimens of them, in consequence of the alertness with which they dive, and the short time that even the head remains above water when they come up for the purpose of breathing. They are, however, the most common of all the larger grebes; and in winter they come down nearer to the sea coast than some of the others.

THE TUFTED GREBE (*P. cornutus*). This species is not quite so common in Britain as the crested grebe; and it is more active as well as smaller, and therefore, not so often seen in proportion to its numbers. It measures about fourteen inches in length, and more than two feet in the expanded wings, so that it is better winged than the former. The bill is only about one inch long, very stoutly made, reddish at the base, dusky in the middle part, and greenish grey at the tip. The colours of the irides form a very certain and invariable character in this species. They consist of two circles, the inner one crimson, and the outer one white. The naked space round the eye is also white; but the streak from the eye to the gape becomes crimson in the breeding season. At this season too the reddish colour on the basal part of the bill is much brighter than at other times. The crest from which the bird gets the name of horned or tufted, the first of which is a very inaccurate expression, is divided into two pointed lobes or branches, and of a dusky colour. The crown of the head is of the same, and the ruff or ear-tufts chestnut, passing into dusky black on the margins; and both crests and tufts have a slight reflection of metallic green. The general colour on the upper part is brownish black; the fore part of the neck and breast are rust-coloured, and the sides and flanks the same, only much paler in the

tint; all the rest of the under part is pure white; the young are without the crest and ear-tufts, and the female has them smaller than the male. The breeding, general habits, and haunts of these birds, differ so little from those of the former species, that the details of them are unnecessary.

THE EARED GREBE (*P. auritus*). This species is still smaller than the former, being only about a foot long, and less than two feet in the stretch of the wings. The name "eared" is not very aptly applied; for the tufts on the head of this species have just as little connection with ears as those of the last mentioned species has with horns. They rise from above and behind the eyes, stand up separately behind the head, and are pale chestnut-coloured, with an orange tinge. The ear-tufts, which are very short in this species, are also orange tinged chestnut at the bases; but they are sooty black at the tips, as are also the head, nape, and upper parts generally, though broken by a few mottlings of dull brown on the scapulars and middle of the back. This black fades into chestnut all round its under margins, and that again into pure white on the middle of the under part. The irides are scarlet; and in the breeding season the streak before the eye is crimson. These birds are also very generally but not thickly distributed; and their habits bear a considerable resemblance to those of the others.

THE LITTLE GREBE (*P. minor*). This is in some respects the most interesting of all the grebes; and as a British species it is perhaps the most numerous. It is found in all latitudes of our mainland, where the situation suits it, and also in the islands. Its motions in the water are exceedingly agile; and in the style of its swimming it something resembles a frog, only it gets on with much more rapidity. Where the banks of the pools and streams are bare, it is rarely met with; but it is not uncommon in the humid parts of the lower country, where aquatic vegetation is luxuriant. As it inhabits nearer the dwellings of mankind than the others, it is not so timid. It is indeed a



Little Grebe.

bold and very voracious, but at the same time far from an ill-tempered bird. It has often been kept in a state of confinement, if not absolutely tamed; and if properly supplied with food, it makes a very interesting ornament to a garden pond; small fishes are

its favourite morsels ; but it will eat other animal food, and occasionally vegetables. There was one lately kept at the Gallery of the Scientific Exhibition, in the Lowther Arcade, Strand, London, which was far from being the least curious piece of mechanism in the place ; and it had the advantage of self-motion. In that gallery there is a very long trough filled with water, for the purpose of making hydraulic experiments ; and the little grebe used to dash along, around and under the floating models with great rapidity, bobbing up its head at the one end, and again at the other before one knew where to look for it. It is but an ungainly walker upon land ; but in its own element it is a very handsome bird.

The usual length is about ten inches, the stretch of the wings about sixteen, and the weight about sixteen ounces. The bill is scarcely an inch long, brown ; irides reddish hazel ; the whole upper parts are of a rusty brown ; pale on the rump ; cheeks are of the same colour as the fore part of the neck, which is grey ; in others of a light rust-colour ; breast and belly glossy white, mottled with ash-colour and light rusty ; in some the rust-colour is wanting, especially in the females ; but both sexes are subject to vary in plumage according to age ; legs dark dull green. As is the case with all the genus, the nest consists of a great quantity of materials, and the birds are in the habit of covering up their eggs when they quit the nest for the purpose of feeding ; the nest is also always so placed as that the bird can escape to the water in case of danger ; but when no danger appears the female is very constant to her eggs. Though these grebes are exceedingly voracious, as was said, and levy heavy contributions on the fry of fishes, the pike, the tyrant of our pools and slow running waters, sometimes retaliates, by seizing and swallowing the little grebes ; nor is this to be wondered at, because that fish has been known to seize the heads of swans while dabbling, and the noses of quadrupeds while drinking.

The foreign species of grebes are numerous ; but little is known of their manners, so that we shall merely mention the names of one or two.

THE PIED-BILLED GREBE (*P. Carolinensis*) is a native of North America ; brown on the upper part, and dull white on the under ; the throat black ; a white circle surrounding the eyes, and a black spot at the base of the lower mandible ; the breast mottled with olive ; the beak ash-coloured, with a black ring surrounding it about the middle ; the feet black. The length of the full grown bird about ten inches. The young have the upper part dark brown ; the sides of the neck, the belly, and the rump, reddish ; and the breast dull white with a large black spot.

THE DOUBLE-TUFTED GREBE (*P. bicornis*). A native of South America, length about twenty-three inches. The bill long and slender ; the crest divided, of a bluish black with metallic reflections ; the upper part dark coloured ; the front of the throat black ; the under part white.

PHILIPPINE ISLANDS' GREBE (*P. Philippensis*) inhabits the eastern islands. It is about a foot long ; blackish clouded with purple on the upper part, with two red lines on the cheeks and sides of the neck ; under parts blackish ash : bill ash-coloured at the base and point, but black in the middle.

THE HOARY GREBE (*P. poliocephalus*). Eleven inches long ; brown on the upper part, with the feathers on the head and cheeks produced and tipped with white ; the under part silvery white : found in some parts of Australia.

THE WHITE-WINGED GREBE (*P. dominicus*) inhabits South America and the West Indies : blackish on the upper part, greyish on the under spotted with brown ; principal quills white with brown tips ; bill black, and feet brown, a very small species, not above six or seven inches in length. There are many others, some of which are found as far to the southward as the very extremity of South America, but those which we have enumerated, must serve as a specimen of birds, whose habits are so nearly alike that size and colour are the leading specific distinctions.

GREBE-COOT (*Podia*). A genus of fin-footed birds, bearing some resemblance to both the genera of which their English name is compounded ; but still having sufficient characters to require their separation from both. They were at one time confounded with the darters which, however, belong to another part of the system, being entire webbed birds, and closely allied to the pelicans. The present genus consist chiefly of two species, the one African, and the other American. The characters are : the bill as long as the head, straight, cylindrical, with the point bent downward and notched, the culmen distinct but depressed ; the cutting edges of the upper mandible a little enlarged, those of the under straight, and angular toward the point. The nasal grooves deep and long ; and the nostrils placed in the middle of each side of the bill, lengthened and entirely opened ; the feet short and placed far backward, and with the tarsi rounded, instead of being flattened and margined as in the grebes, the three front toes united by a lobed membrane, but the hind toe free ; the wings of mean length and pointed ; the first quill shorter than the second, and the second and third the longest in the wing ; the tail is very large, which forms a remarkable distinction between these birds and the grebes. Their manners have been but little studied ; but it appears that they are not nearly so aquatic as either the grebes or the coots.

AMERICAN GREBE COOT (*P. Surinamensis*). This bird is found in various parts of South America. The upper parts are dull brown, but the crown of the head is furnished with long and pendent black feathers ; the cheeks are yellowish brown ; the sides of the neck streaked with black and white ; the eye streak white, extending the whole length of the neck ; the quills having a black band at the ends with a narrow white margin ; the bill ash-colour ; the feet yellowish brown with the lobes streaked with black and white. The length about thirteen inches. It is described as having the head and neck constantly in motion ; and it is further added, that it is a dexterous fly-catcher. Little is said of its manners, however, and it is doubtful how far that little can be implicitly believed.

AFRICAN GREBE COOT (*P. Senegalensis*). This species is found in western Africa. It is about the size of a duck. The upper parts brown, mottled with black on the middle of the back and sides of the neck ; the top of the head and upper part of the neck blackish ; a white streak from the gape over the eye and down the sides of the neck ; all the under part white with the exception of some mottlings of black on the flanks ; tail slender, but very stiff. The manners of this species are just as little known as those of the former. These birds have got the name of *fin-foot*, which is by no means a correct one, because it is the distinguishing character of the sub-order to which they belong, or at least to several genera, belonging both to this and to other parts of the system.

GREEN DRAGON is the *Arum dracontium* of Linnæus, a curious North American herbaceous plant, long introduced into our gardens, and easily increased by offsets from the roots.

GREVILLEA (R. Brown). A fine genus of evergreen shrubs, natives of New South Wales, Linnæan class and order *Tetrandria Monogynia*, and natural order *Proteaceæ*. Generic character: calyx irregularly four sepalled, inserted obliquely; small solitary glands below the germen; stigma obliquely depressed; folliculus one-celled, which is central and two-seeded. As greenhouse plants this genus thrives well in an equal mixture of loam, sand, and moor earth, and is readily propagated by cuttings struck in sand. Above thirty species are named in books.

GREWIA (Jussieu). A genus of evergreen shrubs, mostly indigenous to India. They bear polyandrous flowers, and the genus is arranged in the natural order *Tiliaceæ*.

GRIELUM (Linnæus). A small genus of perennial herbs, from the Cape of Good Hope, belonging to the natural order *Rosaceæ*. They are impatient of moisture, requiring to be grown in sandy gravel and the pots well drained, and propagated by cuttings and seeds.

GRIFFINIA (Ker). A genus of bulbous plants from South America, belonging to *Amaryllideæ*. There are three species described, and, like other tropical bulbs, require a light, turfy soil, kept dry while dormant, but allowed plenty of water when growing.

GROMWELL is the *Lithospermum officinale* of Linnæus, a common medicinal or dyer's plant, belonging to *Boraginææ*. The lithosperma are remarkable for the stony hardness of their pericarps, which have all the brittleness and lustre of porcelain. This membrane, when analysed, is found to contain a larger quantity of earthy matter than any other organised substance.

GROSSULARIÆ. A natural order, containing only a single, though a well known, genus, namely, the *Ribes*, or *Gooseberry*. They are unarmed or thorny shrubs, with round or irregularly angled ligneous stems and branches: simple lobed, alternate leaves, but destitute of tendrils and stipules. The utility and excellence of the gooseberry and currant are well known. None of the other forty-seven species equal these, although the fruit of some others are of some importance. The berry of most of these is sweet, watery, and acid, but that of *Ribes nigrum*, and a few more, is tonic and stimulant, which appears to have some connexion with the presence of glands upon the leaves of those species. See GOOSEBERRY.

GROUNDSEL is the *Senecio vulgaris* of Linnæus, a very common European weed.

GROVE DOCK is the *Rumex nemolapathum* of Ehrhart.

GRUB. A name generally given to any fleshy dingy-coloured larva, whether proceeding from eggs deposited by a beetle, moth, or other insect. It has been attempted to distinguish grubs from maggots, by considering the former as the offspring only of coleopterous insects (beetles and weevils), and the latter as having no feet; but as the larvæ of all weevils, and many other beetles, are destitute of feet, and as the word, as generally employed, is quite incapable of strict systematic employment, we would prefer leaving it in its ordinary indefiniteness rather than limit it incorrectly, as has been done.

NAT. HIST.—VOL. II.

GRUS—Crane, or rather, perhaps, *GRUIDÆ*, the Crane Family, as we shall include in this article a bird or two, which are not, strictly speaking, cranes, though nearly allied to them in various respects. We have already described, in the article *AGAMI*, a species which is closely allied to the cranes, though perhaps even less aquatic in its habits.

The cranes are the first and most typical genus in Cuvier's *Cultrivorostris*, or kniveshape-billed division of *Echassiers*, or stilt birds.

The generic characters are: the bill straight, and not very wide at the gape, and the nasal groove, which is deep, and lined with membrane, occupies nearly one half of its length; the legs are very long and strong, naked for a considerable way above the tarsal joints, and fortified with shield-like scales, which are not, however, reticulated, as in those birds which are in the habit of having their legs habitually in the water; the toes are of moderate length, the outer and middle one united by a short membrane at the base, and the hind toe is articulated so far upward on the tarsus as barely to touch the ground with its point when the animal walks; all the species have the head and part of the upper neck more or less furnished with projecting feathers; the tongue is fleshy, broad, and pointed; the wings consist of twenty-four quills; their stomach is a true gizzard; and the inferior larynx has only one muscle on each side.

By Linnæus and his followers the cranes were confounded with the herons, the storks, and various other genera, but their manners differ from these, and there is a corresponding difference of structure. Storks, according to their different species, feed more upon garbage, and those remains of animal life which are left on the subsiding of the waters in the flooded countries. They are also exceedingly voracious birds, and their gape and throat are very capacious. Herons are more exclusively fishers, and never seek their food but on the margins of the waters, into which they wade to some distance. The cranes, on the other hand, though somewhat miscellaneous in their feeding, subsist in great part upon vegetables, as the gizzard would indicate, although we had no other evidence. Cranes are also much more handsome birds than either storks or herons. They are very tall in stature, their bodies are light and elegant, their gait is majestic, and their crests are much more handsome than those of the other crested birds of the division. Generally speaking, they inhabit the warmer temperate countries, and are migrant with the seasons; but some are found far to the north in summer, at least as far as the shores of Hudson's Bay and the banks of the Siberian rivers. There are several species, each of which is worthy of a short notice; and we shall begin with the only one which breeds in Europe, and once bred in considerable numbers in England, though it now rarely appears even as an occasional visitant.

This shows that England has undergone a considerable change, not only in respect of more abundant population, but in respect of the character of the country, especially in those places which these birds frequented. Cranes are not marsh birds, but they are frequenters of the margins of marshes, though, in places where they are abundant, they spread themselves over the corn-fields, and often do considerable damage by feeding on the tender blade of the young crop.

THE COMMON CRANE (*G. cinerea*) has the body

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generally of an ashen-grey colour, with the throat, the fore part of the neck, and the hind head, dusky ; the crest or cap on the head, and also the quills, black. The bird is about the size of a turkey in the body, and weighs about ten pounds, but, from the great length of its legs, it is nearly five feet in height.

Common cranes are very discursive birds, and range seasonally from the north of Europe to the south of Asia and the north of Africa, and in the latter country they are said to extend their migrations as far as the Cape of Good Hope. On these excursions they fly high in the air, though they experience some difficulty in getting on the wing from the ground. Before taking their spring, they run some paces, raise themselves a little at first, and then unfold a powerful and rapid wing. In the air they form very nearly an isosceles triangle, possibly for the purpose of cutting the element with greater facility. When attacked by an eagle, or the wind is likely to break their order, they close in circles. Their passage frequently takes place during the night, which is known by their sonorous voice, which announces it, and the head of the troop often utters, to indicate the route he is taking, a cry of appeal, to which all his followers answer. Their voices, even on these nocturnal voyages, are exceedingly loud, probably owing to the length of the wind-pipe, and the convolution near its bronchial extremity. When they cry during the day they are generally understood to forebode rain, as is the case with the cries of many other birds which feed partially on those worms which the approaching humidity brings to the surface, not only when the rain actually falls, but when, from the changed state of the air, the evaporation is much diminished. When they are peculiarly noisy and tumultuous, and fly near the ground, occasionally alighting, it is considered as a pretty certain indication of a tempest. On the other hand, when they rise high, and fly onward in regular order, it is regarded as a sign of fine weather. In getting on the wing, the apparent difficulty which they experience does not arise from the want of space in which to move their wings, for their legs are sufficiently long for allowing these to act with perfect freedom, even when the feet are firmly on the ground. They appear to run forward, for the purpose of getting an impetus of the whole body ; and when that is acquired, they jerk themselves into the air by the elasticity of the legs, and move off in very good style, and they are capable of passing over many miles without alighting. When they assemble on the ground for the purpose of repose, which, after a long flight, they take with the head under the wing, they have always sentinels appointed to give the alarm in case of danger. Those sentinels stand on the one leg, as is also the habit of the storks ; and the peculiar structure by means of which this resting on one foot is probably a greater relief to them than resting on both feet, because the balance is then preserved by means of the ligaments, which act by their elasticity as matter, and not by living exertion, as is the case with muscles. The distal extremity of the femur, or thigh bone, where it articulates with the bones of the leg, has a hollow or depression, which, in ordinary cases, receives a projection of the leg bones, and when this projection is received into the hollow, the bones, taken together, are shorter than when it is displaced. When, however, this joint, which is the proper knee-joint of the

bird, though the tarsal-joint is usually so called, is much bent, the projection slides out of the hollow, and bears upon a more elevated part ; by this means the two bones together become longer, which lightens the ligaments, and the resistance of the elasticity of these makes the leg much firmer at this joint than if it were extended, and consequently the one leg, bent as far as it will bend at this joint, forms a very steady support. Many birds have this structure, and are able to rest on one leg for a considerable time, but none have it in such perfection as the cranes and storks.

The common cranes are understood to build in the northernmost parts of their range, and probably as far to the north as Lapland in some instances. They are very common in Sweden, and particularly abundant in the marshes of Central and Western Russia. In some parts of Poland they invade the crops, especially those of buck-wheat, in such numbers, that the farmers find it necessary to employ people to drive them off. The nests are formed in bushes and tufts of tall aquatic plants, close by the margins of the waters. The eggs are only two in number, of a greenish colour, and blotched over with brown spots.

The ancients were very familiar with the manners and migrations of these birds, and mixed them up with their superstitions. The positions of the mountains, both in Europe and in Asia, where they approximate the narrow straits which connect the Archipelago and the Black Sea, naturally bring the whole of the migrant flocks over Greece ; and the plains of Thessaly, and the other more fertile parts, were, and are still, their resting-places, after crossing both the Northern and the Southern Seas. In those days the flesh of the crane was a luxury, and it is also recorded among the dishes served up in old times in England. In the old birds it is black and tough, but said to be at least tolerable in the young ones.

THE GIGANTIC CRANE (*G. gigantea*). This species is also styled the Siberian crane, though the name is scarcely appropriate, inasmuch as the bird appears to be found in the northern parts of both continents. It is a much more northerly inhabitant than the common crane, and in the eastern continent it probably does not get farther south in the winter than the latitudes of the Caspian and the lake Aral, while in the summer it ranges far to the north along the banks of the Siberian rivers in all places where there are marshes. In America it has been observed in the marshes near Hudson's Bay, or at all events a bird has been observed there so like that of the north of Asia that there is no specific distinction between them. It does not appear that this crane occurs in the European division of the northern migration ; but it is probable that it ranges from Hudson's Bay westward to Nova Zembla, migrating with the seasons, though not reaching the tropical countries.

The general colour of this species is snowy white, with the ten first quills black, and the bill and feet reddish. It is a very majestic bird, and when it raises its long neck it stands four feet and a half high. The young of the year are of an ochre colour, with the forehead, bill, and legs, greenish brown ; and very old birds have a yellowish tinge on the back of the neck. These birds have been most observed in Siberia, where they feed upon fish and lizards, frogs and other reptiles ; they are very vigilant birds, shy and cunning, and it is difficult to get near them, as

they move off when the slightest noise is made or alarm given. This is, in all probability, the reason why less is known of them than of the common cranes in the more southerly parts of their migrations. The nest is constructed in the most inaccessible situations, and carefully concealed among reeds or other tall herbage. The eggs are two in number, about the size of those of a goose, ash-coloured in the ground, and spotted with pale brown. From the concealment of the nest, it is not easily discovered, but when it is, the female defends her eggs and also her young ones with great boldness, and on such occasions, from her strength, the power of her bill, and her dexterity in the use of it, she makes a stout defence against both men and dogs.

THE NUMIDIAN CRANE (*G. virgo*). This species is generally styled the demoiselle crane, as is supposed from the comparative lightness and elegance of its form. It is not near so large as the last mentioned species, being only about three feet three inches in height, and the form of its body is light and slender. Of the height, the legs and neck make up a very great proportion, as they are exceedingly long. The general colour of the body is bluish grey, but the crown of the head and tips of the primary quills are black. Behind the eye on each side there arises a tuft of white feathers, which unite and form a sort of crest on the occiput. From the lower neck and breast there are long and slender black feathers which hang over the others, and are very silky and flexible in their texture.

Though called the Numidian crane, and probably more abundant in Northern Africa than any other part of the world, these handsome birds are not confined to that country. During the overflowing of the Nile they are by no means rare in Egypt; and in autumn they are sometimes met with as far to the northward as Constantinople. Indeed they are met with on the southern shores of the Black Sea, the Caspian, and lakes Aral and Baikal; though it does not appear that they reach so far northward as the summer haunts of the great Siberian crane. They are found on the banks of rivers and lakes, where they feed chiefly upon fish. They are brisk and lively birds, gentle in their manners, very easily tamed, and capable of some instruction. In the wild state indeed they are very prone to a sort of dancing motion; and in confinement they may be taught to dance and perform several other feats at the bidding of their keepers. They are very attached, fond of being caressed, and strut about with apparent pride when they are noticed. In the south-east of Russia, and in the country extending thence to the Caspian, which abounds in salt lakes, they breed on the margins of these; and the females are said not to conceal their nests so much as some of the other species. They can not only be made to join other domestic birds in farm yards, but there have been many instances of their breeding freely in a state of confinement. They are hardy and also long-lived, and Buffon mentions one which was hatched at Versailles, and lived four and twenty years. There are some in the gardens of the Zoological Society of London, which are very tame; and there is no doubt that they could be pretty generally introduced wherever ornamental birds are kept with proper attention. They are very industrious and successful fishers, however, and would of course lay the fish ponds under heavy contributions.

THE CROWNED CRANE (*G. parvonina*). This also

is an African species, inhabiting to the southward of the desert, or at least found most abundantly in that part of the country. It has been styled the Balearic crane, which appears to be a misnomer, as there is no evidence that it breeds in the Balearic isles, on the east coast of Spain, or even visits them. The rich and humid parts of Western Africa are its favourite haunts, and there it is a very tame and familiar bird. It can be tamed, and is as fond of attention as the preceding species; and the natives of Africa regard it with a sort of veneration, and endeavour to prevent it from being destroyed. In confinement it bathes frequently in cold water, and will eat either vegetable or animal food, though it prefers small fishes to every thing else. It is an exceedingly showy bird; slate blue on the upper part of the body, with the tail-feathers and quills black and bright brown, and the coverts of the wings pure white. The sides of the head are naked, and so is a portion of the throat, from which there hangs a sort of wattle, all which naked skin is rose colour, or bright red. A close round tuft of black feathers covers the front and crown of the head, from behind which there rises on the occiput a beautiful crest or crown of yellow thread-like feathers, which are twisted spirally and have black points. The bill and feet are black, and the irides are almost without colour. Its ordinary walk, though majestic and stately, is slow; but when it spreads its wings as a means of balancing itself, it can run with great rapidity. It is also a bird of long, powerful, and very elevated flight. Its cry is a loud and hoarse clang; but when pleased it can also utter a sort of clucking sound. From its form, its size, the strong contrast of its colours, its measured gait, and its familiar manners, it is one of the most attractive birds in an aviary. Like the rest, however, it is of very little value as an article of food; and therefore it can be considered only as an ornamental bird.

Respecting the other birds which resemble the cranes, less is known. They are natives of South America, especially of the plains of Paraguay; they are,

COURLAN, or COURLIRI (*Aramus*). The characters are: the bill longer than the head, hard, strong, compressed laterally, straight for the greater part, but slightly curved toward the tip, where it is a little enlarged. The upper mandible is slightly furrowed, and the under one is enlarged at the middle, angular, and pointed. The nostrils are linear at the sides of the bill near the base; the tarsi are long; there are four toes divided to their bases, the front ones smooth on their under sides and slender, and the fourth are articulated on the hinder part of the tarsus, but in such a manner as that it bears upon the ground. The wings are of mean length, the first quill very short, and the third the longest on the wing. Those characters indicate a difference in haunt and in habit from the cranes; and though the manners of the birds are very little known, it is understood that they are peculiar, that they do not enter the waters even as waders, or fish, but live upon snakes and other reptiles on the humid parts of the land. There are at least two known species, *A. caran* and *A. scolopacea*. The first is blackish brown on the upper part, with a tinge of purple on the back and rump, feathers on the head and sides of the neck brown with white centres; lower parts brown, spotted with white on the belly; bill yellow with black tip; irides red; and feet ash colour; length about two feet three inches. The second spe-

cies has the plumage deep brown, with reflections of red and green on the quills and coverts; the upper part of the neck white; the bill reddish ash, with a blue tip; and the feet blackish; the length about two feet nine inches.

CAURALE (*Eurypyga*) inhabits Guiana. The head black with white lines, the neck yellowish brown, the upper parts beautifully marked with brown, red, and yellow. It is found along the banks of the rivers, but very little is known respecting it farther than that it is a handsome bird, and does not readily fall within any genus of which there are species in the east.

GRYLLOTALPA (Latreille.) A genus of orthopterous insects belonging to the section *Saltatoria*, and to the family of the *Achetidæ*, or crickets; the type of the genus being the *Gryllus gryllotalpa*, Linnæus, or the *Gryllotalpa vulgaris* of recent authors, generally known by the ordinary English name of the mole cricket. See the articles CRICKET and ENTOMOLOGY, in the latter of which the curious fore-leg of this insect, formed for burrowing under ground in the same manner as the mole, is represented.

GRYLLUS (Linnæus). Under this name Linnæus comprised a very extensive group of insects belonging to the modern order *Orthoptera* (part of the *Hemiptera*, Linnæus), and forming, in recent classifications, the section *Saltatoria*, or those furnished with hind legs fitted for leaping, as described in our article GRASSHOPPER. This group of insects, however, comprised three very distinct sections, and these have been raised to the rank of families by more recent authors, although the nomenclature of such families is very confused.

The first of these families comprises the crickets, of which an account will be found, p. 176 of the present volume. It is named *Acheetidæ* by Leach, but by Latreille *Gryllides*, and by Mac Leay *Gryllina*.

The second family comprises all the grasshoppers which have long antennæ. These are the *Grylli tettigoniæ* of Linnæus, the *Gryllidæ* of Leach, the *Locustariæ* of Latreille, and the *Locustina* of Mac Leay. We have already, in our article upon the CRICKETS, alluded to the incorrect application of the latter names, which ought surely to be given to the family containing the destructive locust, and which is the type of

The third family, named *Gryllus locusta* by Linnæus, *Acrydii* by Latreille, *Acridina* by MacLeay, and *Locustidæ* by Leach, and which is distinguished from the grasshoppers belonging to the second family by the shortness of the antennæ, which are filiform, prismatic, or sometimes slightly thickened at the tips. To this family belong a very great number of small species, common in this country, found amongst grass and in hot sandy places, and to which the name of grasshoppers is applied, as well as to the species of the former family. Further details relative to these insects will, however, be found under the head LOCUSTIDÆ. It only remains for us, therefore, in this place, to give an account of the species belonging to the second family, or the true *Gryllidæ*.

In addition to the principal characters derived from the great length of the setaceous antennæ, the tarsi are only four-jointed; the ovipositor of the females is long and often sabre-shaped, and the upper wings of the male exhibit a glass-like area, described more at large in our article GRASSHOPPER. From the cricket family they are distinguished by the wings being deflexed when at rest; the mandibles are not

so much toothed, and the exterior lobe of the maxillæ larger than in the last-mentioned insects.

These insects, at least such as inhabit this country, are comparatively of a large size, considerably exceeding the other grasshoppers in this respect; indeed the typical species may be regarded as our most gigantic insects, although the exotic *Locustidæ* considerably exceed them in bulk, as well as in strength and compactness of structure. There are about a dozen native species, but the exotic and tropical species are far more numerous, as well as more beautiful in their colouring. Mr. Kirby united them into a single genus, to which he applied the name of *Acrida*; but more recent authors, who have extended their investigations to the entire family, including the exotic species, have established numerous generic divisions, and the native species are now distributed into the following six genera, in the work of Mr. Stephens, published during the past summer, viz.: *Ephippigera*, *Micropteryx*, *Xiphidion*, *Meconema*, *Decticus*, and *Phasgonura*. The last-named genus is distinguished by having the crown of the head acute produced in front, between the antennæ; the eyes large and prominent; the wing-covers large in both sexes, those of the males having a small ocellus; the ovipositor of the female long and straight, and the under side of the thorax armed with two spines and four lobes. This genus comprises the common great green grasshopper (*Gryllus viridissimus*, Linnæus), which is nearly two inches long, and found at the beginning of autumn in grassy places and in hedges by the sides of woods. We have found it not uncommonly in Battersea-fields. Lehmann, in his memoir "De sensibus externis insectorum," &c., p. 23, records some curious observations upon this insect, made by an Italian naturalist with a view to ascertain their powers of hearing. These insects, which fill the meadows with their singing, immediately become silent on our approaching the spot, so that it is difficult to trace their retreat, unless the greatest caution is used in seeking them. Brunelli tried various experiments with numerous individuals, which he kept in a chamber, and which kept up a constant chirping all day long. A knock at the door, however, immediately silenced them. He also learned to imitate their chirp, and when he performed this outside the door of the room, a few only would at first reply, but by-and-bye the whole joined in the chorus with all their force; on tapping again at the door, they were silent and alarmed. He also placed a male in a little cage in his garden, and set a female at liberty, which, as soon as she heard the chirping of the male, approached and leaped upon his cage, which was also the case in whatever part of the garden the female might be.

These insects are, like the locusts, herbivorous, feeding, in all their states, upon grass and herbs, although, when confined together in a small box, they will devour each other. This, however, appears to be the result of fear, rather than a natural appetite. We once caught one of them, which, being held by one of its hind legs, gave a sudden spring and jerked off its leg, which was placed with the insect in a bottle; by the following morning, however, we found that this portion of itself was half devoured. The long ovipositor with which these insects are furnished, enables them to deposit their eggs at a considerable depth in the earth, in small rounded cells. The young ones, when hatched, resemble their parents in form

as well as in activity ; they are, however, destitute of wings and wing-covers. In the state immediately preceding their arrival at that of the imago, the wings and wing-covers appear as rudimental upon the back of the second and third segments of the body.

The other genera do not merit particular notice in a work like the present, being distinguished only by slight structural differences.

GRYPHŒA (Lamarck and modern authors). This genus of molluscs has hitherto been considered an *Ostrea*, to which in fact it bears a great resemblance, but the texture of the shell is more finely lamellar, and the peculiar characters of the lower valve, which is very deep and carinated, its summit terminated in a long spirally recurved beak, slightly turned to one side, the edge sharp and angular, and the fact of its never being attached to other bodies, or if it is, only at one small point, clearly in our opinion distinguishes it from the genus *Ostrea*, though Sowerby, in his *Genera of Shells*, points out some strong grounds of objection to Lamarck's separation. The shell is inequivalve, the lower valve very large, concave, of an oblong elongated form, carinated or ribbed, and terminating in a spirally recurved beak ; the upper valve is small and flat, fitting into the lower one at a small depth from its marginal edge, another characteristic distinction from the *Ostrea*. The hinge is without teeth, it has an arched and oblong cardinal cavity, and there is only one muscular impression on each valve, as in the oyster. Recent examples are rare, and only one species is at present described. In a fossil state they are abundant. The animal is unknown. This genus is placed, in the French system, immediately after the oyster, in the first family *Ostracea*, of the third order *Lamelibranchiata*, third class *Acephalophora*.

GUAIACUM (Linnæus). The *G. officinale* is a West Indian tree, which produces the medicine called gum guaiacum. Class and order *Decandria Monogynia*, and natural order *Zygophylleæ*. The wood is remarkably hard, and known in commerce as *Lignum vitæ*, so much used in turnery for ornamental purposes. The timber of *G. arboreum* is also very solid and ponderous, especially when buried, so that the natives of Cumana believe it becomes converted into stone. The plants in our stoves grow freely in a mixture of loam and moor earth, and may be increased by cuttings struck in sand.

GUAREA (Linnæus). A genus of West India timber trees belonging to the eighth class of the sexual system, and to the natural order *Meliaceæ*. The *G. trichilioides* has been long an inhabitant of our stoves, and may be increased by ripened cuttings struck in sand.

GUATTERIA (Ruiz and Pavon). A genus of tropical shrubs and one tree, known by the name of lance-wood. Class and order *Polyandria Polyginia*, and natural order *Anonaceæ*. They are managed and increased much like other stove plants.

GUAVA is the fruit of different species of the *Psidium* of Linnæus. Class and order *Icosandria Monogynia*, and natural order *Myrtaceæ*. They bear the fruits called sour-sop and sweet-sop in the West Indies, and for which they are cultivated. Several of the sorts are readily fruited in our stoves or green-houses, and are increased by layers, cuttings, and seeds.

GUDGEON (*Cyprinus gobicus*). A genus of soft-

fined fishes, with abdominal fins belonging to the carp family ; one species only is known in the British waters, but it is probable that there may be another. With us they are found only in the slow running streams of pure water, in the southern part of the island. They are small fishes, seldom exceeding eight inches in length, and rarely as much, but they are light and much esteemed as food, especially for invalids, it being understood that they are remarkably easy of digestion. They keep near the bottom, and feed upon water insects, small mollusca, and the spawn and young fry of other fishes. They are usually found in shoals ; and are so remarkable for the readiness with which they can be taken with almost any bait, that a person who can be imposed upon by shallow devices is proverbially termed a gudgeon. They spawn in May, in the shallows, it being understood that their ova require much heat to bring them to maturity, which may be the reason why they are not found in our northern or upland rivers. They afford some sport to those bungling anglers who can catch nothing else ; for it is a common saying, that anybody can catch gudgeons. It is usual to collect them by scratching the bottom of the water with a rake, which brings them together in search of what food may happen to turn up for them.

GUELDER ROSE is the *Viburnum opulus* of Linnæus. A well-known flowering shrub, indigenous in Britain, of which two varieties are cultivated in gardens.

GUERNSEY LILY is the *Nerine sarniensis* of Ker. A bulbous-stemmed fine flowering plant, common in every florist's collection.

GUETTARDA (Linnæus). A genus of South American trees belonging to *Rubiaceæ*. The flowers are fine and nearly related to gardenia.

GUILANDINA (Jussieu). A genus of Indian shrubs, with decandrious flowers, and belonging to the order *Leguminosæ*. It is otherwise called the nicker tree, or *bonduc*, has been long in our collections, and is increased by cuttings rooted in sand.

GUILLEMOT (*Uria*). A genus of web-footed birds, belonging to Cuvier's short-winged or diving family ; much less fitted for getting through the water than most of the others, and no great adepts at walking on the land. They are thick and clumsy birds ; and very much at the mercy even of storms when in the sea. They inhabit the northern seas, and seldom come southward, except when compelled by the violence of the weather. They dive with great address, and also catch their prey with no inconsiderable adroitness. They form as it were a link between those birds which may be said to be equally fitted for the air and the water, and those others in which the aquatic habit predominates. During storms they are frequently cast ashore in a state of complete exhaustion, and sometimes they are thrown so high upon the rocks by the surge, that they are unable to get down again, or to escape, in consequence of their awkwardness and the shortness of their wings. In general, however, they endeavour to make as far to seaward as possible, and thus ride out the storm on the water. They are seldom found on the inland waters, or far up the estuaries of rivers, but when they appear in Britain, or rather in the British seas, they are chiefly on the rocky shores. On all parts of those shores they are more abundant than the divers properly so called ; but they are not more productive, inasmuch as the female lays only one egg.

The generic characters are : the bill of a middle size, or rather short, very stout, straight, pointed, compressed laterally, sharp at the tip, and with a distinct notch near the extremity of the upper mandible ; the nostrils are at the base of the bill, lateral, longitudinal, half closed by a feathered membrane, which acts partially like a valve ; the legs are short, placed far backward with slender tarsi, and only three toes, all turned to the front, and webbed. The wings are short, but very closely feathered, and capable of acting like fins under the water. They are social in the breeding times, and the females place their single egg in a hole of the rock, and sometimes on the bare ledge, without even a rudiment of a nest. They moult twice in the year ; and when in their complete winter plumage, there is a little difference in the plumage ; and in this respect the young do not differ from the old birds. There are three or four species, though one of them has been separated from the genus by Cuvier, and perhaps such ought to be the case.

FOOLISH GUILLEMOT (*U. troile*). This species is known by a number of provincial names ; and it gets the English epithet above quoted from the fact that, in places where the birds congregate, and are seldom molested, they will sometimes allow themselves to be taken with the hand. The length is about eighteen inches, the stretch of the wings two feet four inches, and the weight from a pound and a half to two pounds. The body is of an oval form, of nearly equal thickness at both ends, which is very different from the shape of those birds which get most speedily through the air. It is, however, in great part the general shape of the grebes and divers, and also of the diving ducks ; so that it seems the best one for getting along when wholly immersed in the water. One of the most remarkable differences in external appearance between this bird and the grebes and divers, is the shortness and thickness of the neck, whereas these have it slender and graceful. The head, however, is long, and the bill pointed, and thus well calculated to divide the water before it. The bill appears much shorter than it really is, because of the feathered membranes of the nostrils, which advance half way between the gape and the tip, and thus the bird can make a wider mouth than one would at first sight suppose. The plumage on all the fore part is remarkably close and smooth, and of a blackish brown colour ; the upper part is the same but paler, and there is some white in the tips of the secondary quills ; the under part is pure white, and has the feathers as close and smooth as those on the head and neck ; and this white comes round the elbow of the wing, so that the colours are strikingly contrasted. In winter the fore neck, the throat, the chin, and partially the cheeks, become white, and the dark brown on the rest of the upper part becomes dull grey. The young birds have the winter plumage and not the summer ; and thus they are readily made different species by those who do not attend to the changes.

This species is found in all the northern seas of both Europe and America ; and when they are frozen out in the extreme north, they resort to the shores as far south as the coast of France. They are not so common on the southern shores of England, though they breed about the middle latitude of both sides of the island. In Orkney and Shetland they are met with all the year round. They approach the lonely island of St. Kilda about the beginning of February ;

and by the people there, who live much on sea-birds, and at some seasons of the year have the streets of the village paved with feathers, their appearance is hailed with pleasure. It is said that on their arrival they are caught by what seems a very shallow device : the bird-catcher lies down on a ledge of the rock during the night, with a piece of white cloth tied round him ; the birds see the cloth more easily than the rock, and alighting on it one after another, numbers of them are captured. In their favourite places they nestle thickly together in the breeding season, depositing their single egg on the bare rock : this egg is of large size, and beautifully mottled with black, blue, green, yellow, and white. The colours are, however, subject to great variation ; and in birds which build upon the exposed rocks, it is very common to see the coloured eggs which are placed high up, much paler than those which are low down. The females seldom quit the egg during the whole period of incubation, but have their supply of sprats and other small fishes brought to them by their partners. In places where sprats or herrings, or other small fishes, which appear in large shoals, are periodical in their visits, their coming is always attended by an unwonted supply of guillemots.

THE BLACK GUILLEMOT (*U. grylle*), is less than the former, but proportionally thicker in the body. It is fourteen inches long, about twenty-two in the stretch of the wings, and not a pound weight. Its general colours are black above, and white on the under part and cheeks, and with a white patch on the middle of the wing. It continues resident on many parts of the British shores during the whole year ; but the upper parts become so much paler in the winter, that the bird might be easily mistaken for a different species ; except during the breeding season, it is seldom seen but on or in the water. It flies low, and cannot take the wing from the ground without considerable difficulty. The feathers upon it are remarkably close, and the Greenlanders use its skin as an article of clothing, though its smell is very rank, as is also the flavour of the flesh. The breeding is very similar to that of the first mentioned species, but the egg is smaller, and not nearly so rich in the colours. The young are mottled as compared with the mature birds : and having been observed in this state in remote places, it has been described as a different species, under the name of the "marbled guillemot." Like the former, this one is found in all the northern seas, both of the eastern and the western continent, at least so far as those seas have been explored ; and it should seem that this one especially, forms attachments for life ; for it is rare to meet with a single bird or an odd number ; and where there is a number it is usually a number of pairs, each pair keeping together, and apparently assisting each other in their fishing. It is more active as well as more shy than the former species, and therefore not so easily caught. The Greenlanders, however, do contrive to capture great numbers, which they eat with a zest, of which we can form no notion.

These appear to be the only well established species of true guillemot ; but there is another which is, generally speaking, a still more northerly inhabitant, and which resembles them in many particulars. This is,

THE ROTCHE (*Mergulus melanoleucos*). Cuvier gives the name of the "Greenland dove" to this bird only, but that name is also applied to the black guillemot. This is a smaller bird, being only about

nine inches long, sixteen in the extent of the wings, and five ounces in weight. Its bill is not so decidedly a fishing bill as those of the guillemots, and its wings are more powerful in proportion to its weight. Thus



The Rotche.

it is much more of an air bird, and more discursive than either of them. In summer, it is generally met with in the openings of the polar ice, dipping into the water, and probably feeding upon those small animals which inhabit the well known green-water of those seas, and are in fact the cause of its particular colour. The numbers of those birds which are met with in the extreme north, during the summer season, is almost incredible; and their flesh is represented as being much better flavoured than that of the guillemots. When they visit the British shores, which is chiefly in the winter, they remain nearer the land than the others; and upon land they walk much better. The bill in this bird is very short, not the length of the head; and therefore we may conclude that it is not fitted for following its prey to any very great distance through the water. In the summer plumage, the breast, the under part, the tips of the secondary quills, and a spot above the eye are white; and all the rest pure black. In winter, the throat, sides of the neck, and flanks, become white, and the black on the upper part changes to brownish. These alterations are seldom complete however in the birds which visit our shores, though they are understood so to be in the north. Some of them remain to breed on our most northerly islands, but by far the greater number remove nearer the pole. In their breeding, there is a difference between them and the guillemots, which would be of itself a sufficient generic distinction: the female lays two eggs, whereas no female guillemot lays more than one. Those eggs are of a spotless green colour, and never placed but in some hole or crevice of the rock.

GUINEA PEACH is the *Sarcocephalus esculentus* of Afzelius. A cultivated fruit of Sierra Leone. It belongs to the fifth class and first order of Linnæus, and to the natural order *Rubiaceæ*.

GUINEA PLUM is the *Parinarium excelsum* of Don. A lofty fruit tree common at Sierra Leone. The genus belongs to the *Chrysobalanææ*.

GULL (*Larus*). A genus of web-footed birds, belonging to the long-winged division, and one of the most characteristic which are to be met with on the sea. They are exceedingly numerous, much on

the wing, and particularly noisy. They are birds of powerful wing, and also well adapted for walking on the shores, and some of them migrate inland at certain seasons of the year, and in certain states of the weather. Those which have this habit mingle freely with land birds in seeking their food on the newly-ploughed lands near the sea. They find their sea-food indiscriminately in the waters and on the shores; and when they alight on the water they can ride buoyantly so as to rest themselves. But they are air-birds rather than aquatic ones, though they derive the principal part of their food from the sea.

Gulls are found on the shores of all latitudes, and they are very discursive, and often met with far from the land, not so far, indeed, as the albatross, the tropical bird, the petrels, and some of the terns, but still a considerable way from the shores. When those birds which are discursive over the sea are taken by severe gales, they have no such means of rest as land-birds have under similar circumstances. Generally speaking, the land bird can get some shelter, some elevated object which the wind does not agitate, in the lee whereof it can pause with some sort of repose until it recovers its powers; or, even if it cannot do this, it has the solid ground on which it can crouch down, and there in so far recover itself, while the wind sweeps over it. On the sea, however, there is no such refuge for a weary wing; and, therefore, those birds which are discursive upon the broad waters are much more buffeted by a gale, when caught in it, than the land birds are. The wind sweeps over the surface of the waters with much more velocity, in proportion to its general violence, than it does over the surface of the land, because, from the general level of the watery surface, and also from the extent to which it yields to the action of the wind, there is far less friction between the air and the water than there is between the air and the land, whatever surface the land may have. Any one may be convinced of this by standing, first on the lee, and then on the windward shore, of even a moderate expanse of water, say a river not broader than that one can readily see across it. Standing on the windward shore, it will appear to be only a moderate, or, at all events, a brisk gale; while standing on the lee shore, when the wind comes from the water, it will appear a violent tempest. The difference of violence will also tell in the different degrees to which the surface of the waters is agitated. On the windward there may be barely a ripple, while leeward there is violent agitation; and there is a gradual increase of the waves all the way, clearly proving that the wind gains power in blowing across the water, which it does not gain in blowing across the land.

In the case of gulls, and other air-birds of the sea, which, though they go to considerable distances, are not absolutely "far at sea" birds, but merely coasters which venture a good way from the land, though they still own that land as their home, they are always taken on a lee shore when a storm gets the better of them. If the wind blow from the land, they can fly against it, and so make for the shore, with considerable labour, no doubt, but still without any drifting, such as happens to them when they attempt to fly before a wind with which they cannot keep pace. Indeed, it is only such a wind that completely takes the power out of those birds, and so drives them before it, like wingless things, until their mere gravitation

(their wings having lost all power) brings them down to the surface of the water. This often happens to the gulls, because, in those seasons when they are most discursive, that is, when they associate to visit their breeding-places in the spring, and when they take their departure from them in the autumn, the winds are most inconstant.

The birds are no doubt well protected, by the nature of their plumage, when the wind deprives them of the use of their wings, and brings them in contact with the water; and though the water is in agitation, and the waves are swinging in mountains, or yeasting high in broken water, there is still a safety for the sea-birds on the surge which those who have not studied the matter are probably not aware of. It is true that the gulls, and other surface-birds which do not dive, and thus penetrate the curling crests of the waves, have not so much safety as the divers; but still there is one part of the wave upon which the storm-beaten bird can find shelter, and generally also food. This is a very curious circumstance in the agitation of the sea, and it holds even at great distances from the shore. Waves are merely vibrations of the water, and in the slope of each wave, somewhere about the middle of its height, or in a line, if the wave is linear, which does not partake in the violent motion with which the crest and the hollow alternately change places. The wave turns upon this point or line, just as a vibrating balance turns on its axis, or as a pendulum swings on its point of suspension. This centre of motion in the vibrating wave is comparatively at rest; and as it is approached either from the ridge or the hollow—and it is of little consequence which, for these alternate with each other—there is comparatively little motion of the water. It is true that, in violent gales, more especially when they blow in gusts, waves are never simple; and thus the centre of one wave, which, if there were but that one, would be a point of comparative rest, is itself in motion upon another wave. Notwithstanding those circumstances, there is a most convenient resting-place for the sea-bird upon the troubled waters; so that it actually is in less danger, and suffers less fatigue, than if the surface were waveless under the same violence of the wind. Indeed, if we were to suppose a gull, which can ride in the storm till it has recovered itself, to be placed on smooth ice, and even half the violence of wind to beat upon it, it would be swept away like a thistle-down, and destroyed by the violence of the motion. But, upon the point of motion in the wave, the turning point, as it were, the bird rides secure, and in the alternations it has the shelter of the lee, and when it is most exposed to leeward, the wind only beats it against the soft resistance of the water, without much tendency to drive it from its place.

This circumstance is well worth attending to by every one who wishes thoroughly to understand the economy of the long-winged sea-birds, and how well they and the water and the storm are tempered to each other. In almost every account which has been written, even by eye-witnesses, of the conduct of gulls and similar birds, when unable to keep the sky in a gale, there is wonder expressed at the miraculous escapes which the creatures make. As seen from the shore, they appear at one moment to be whelmed in the foaming crests of the waves, and plunged to utter destruction; but, no sooner does the vibrating wave turn, than they are found upon the lee side, rocking

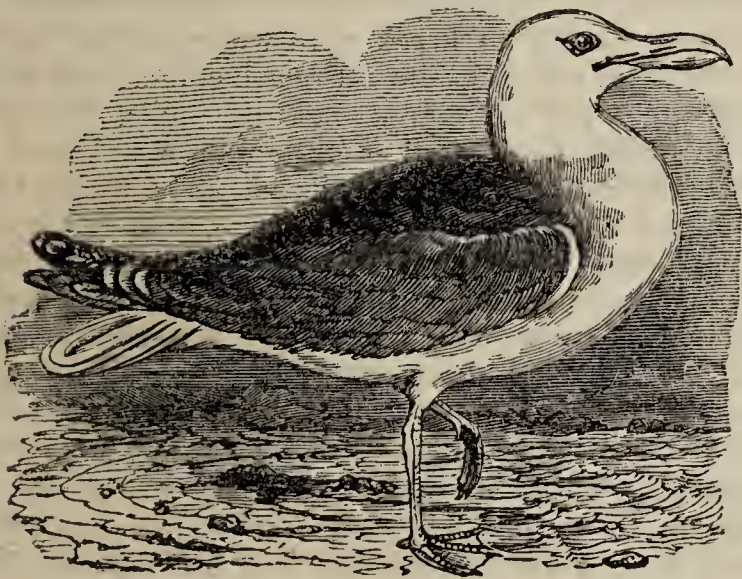
in perfect security, and without a single feather being wetted. Not only this, but that every vibration of the wave, and the consequent rest, or comparative rest, of its centre of vibration, brings food to the birds. The little fishes, the small floating animals, and the general waste of the sea, are all thrown to this point; and one who has the opportunity, and attends carefully to the action of gulls, may often perceive them floating and feeding at their ease amid the turmoil of very formidable waves. So beautifully does nature adapt every creature to those circumstances in which she places it.

We have mentioned these circumstances, because the gulls, from their size, their numbers, and their general distribution, are the birds in which they may be most easily verified by direct observation; and, having done this, which forms a most interesting sea-study at those times when the sea is most worthy of being studied, we shall proceed to make a few remarks on the birds themselves. There are two distinct genera to which the common English name of gull is given. They have not much in common, farther than that both are air-birds belonging to the sea; and, indeed, they stand in so opposite relations to each other, that, while the one genus are "gulls," the other genus are "gullers;" that is, they live by plundering the gulls properly so called. We shall, however, save some room, and make our account of them both more complete, by taking the two genera consecutively in one article. The *gulls*, properly so called, form the genus *Larus*; and the others, the *skuas*, form the genus *Lestris*, that is, robbers or plunderers.

GULLS PROPERLY SO CALLED (*Larus*). These are often divided into two sections; but, as the divisions consist only of those which are larger, and those which are of smaller size, they are of little consequence. We shall, therefore, consider them as one only. The generic characters are: the bill long, or middle-sized, strong, hard, compressed, sharp-edged, hooked towards the tip, lower mandible forming a salient angle; nostrils lateral, in the middle of the bill, longitudinally cleft, straight, and pervious; legs slender, naked above the knee; tarsus long, three fore toes quite webbed, the hinder free, short, placed high on the tarsus; tail-feathers of equal length; the wings long. The birds of this genus are diffused over almost every maritime country; but in the northern and southern extremities of the world they breed most freely, and with least disturbance. Flocks of them haunt the sea-shore in search of living or dead fish; and such is their voracity, that scarcely anything comes amiss to them, for they will greedily feed on putrid carcasses of whales, and the refuse of the tide, and they will contend with one another for the most loathsome fare. In the eager indulgence of their ravenous propensities, they swallow the hook along with the bait, and, like other predacious birds, they throw up pellets of feathers, and other indigestible matters; nay, when harassed or alarmed, they with great facility bring up their food, and, should they be allowed to recover from their surprise, they will again swallow what has been disgorged. Like all voracious animals, gulls are capable of enduring hunger for a long time; and though their favourite food is animal substances, want will bring them to feed readily upon vegetables. The old ones are generally unbroken in the colours of their plumage, though different parts of the body are of different colours. The young are

almost invariably mottled, and as they do not acquire the adult plumage till three years, and differ a little in each year, there has been a great deal of unnecessary multiplication of species. The full-grown ones moult twice in the year, and the principal seasonal distinction is more white in the winter than the summer. Between the sexes there is little difference, except that the male is larger than the female. Some species breed on the cliffs, and others in the marshes and by the margins of the pools inland, it being understood that the rock-breeders are more exclusively fishers, while the marsh-breeders feed more upon garbage, worms, and other small animals. All of them are, however, very miscellaneous in their feeding, and they have been not inaptly styled the vultures of the sea. When they congregate in numbers to breed, they are exceedingly clamorous; and they often collect at other times in vast numbers at particular places of the shore, when they are equally noisy. It is understood that these clamorous meetings are certain indications of bad weather, more especially when the marsh-breeders quit the sea and fly inland. The flesh of old birds of all the species is tough, and rank in the flavour, though it is readily eaten by the Greenlanders, the Esquimaux, and other tribes of the extreme north. The fact is, that the flavour of rancid fish-oil, which is so offensive to us, is the choicest relish to these people. The young of some of the species are sold in the markets in various parts of this country, and are not unpleasant food. The eggs of many are also eaten in great numbers. There is still some doubt as to the number of species, and, from what we have mentioned of the changes of colour, the subject is one of considerable difficulty, therefore we shall mention only the principal ones.

BLACK-BACKED GULL (*L. marinus*). This species is found generally diffused over the seas of both continents and in both hemispheres; though on our own shores at least it is not so plentiful as several of the others, occurring most frequently in pairs, and seldom in flocks of more than a dozen. It remains in



Black-backed Gull.

the same haunts all the year round, but those haunts are rather particular spots. It is the largest species of the genus, measuring at least two feet and a half in length, and six feet in the stretch of the wings, and weighing about five pounds. The shoulders are bluish black, the feet flesh-coloured, the bill yellow with a red spot on the projecting angle of the lower mandible. The quills are black, marked with white bars, and have white tips. The young till the third year are mottled with brown and white. It does not

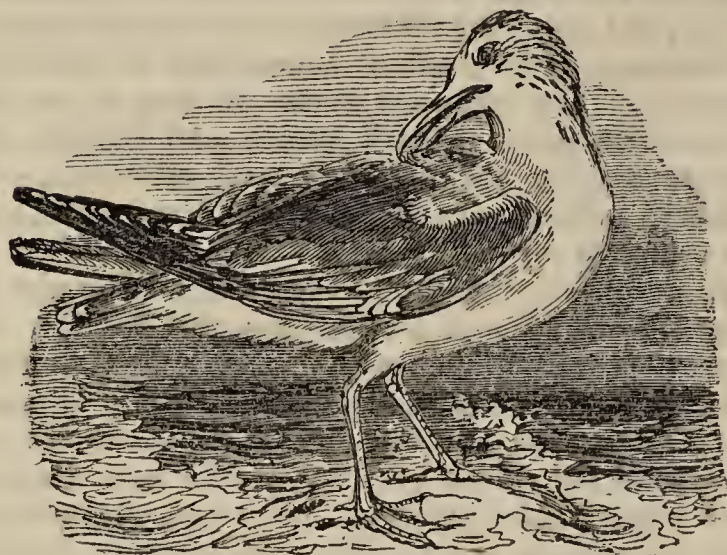
associate with the other gulls, and seldom admits them near its haunts. It feeds chiefly upon fish, but it also attacks ducks and other birds. It is exceedingly ravenous, attacking all manner of garbage and carrion, whether cast on shore or floating on the water; and it will often tear fish from the hooks on the fishermen's lines. Its usual cry is exceedingly harsh. The young may be tamed; but they require a great deal of food, which they devour so greedily as to remain for a considerable time afterwards motionless, with the head almost buried in the feathers. The greater number of the northern ones breed far north; but there are others which breed on the shores of England, as far south as Lundy Isle in the Bristol Channel. The eggs are three or four, of an olive colour with spots of dark brown and purple; they are eaten, but they are not very palatable. The northern people eat the young, and use the skins of the old birds for clothing.

BURGOMASTER GULL (*L. glaucus*). This also is a large species, though smaller than the former. It is about twenty-eight inches long, more than five feet in the stretch of the wings, and weighs about four pounds and a half. In summer the back, shoulders, and coverts of the wings, are bluish ash; and the quills have white shafts and tips. The bill, which is very long and strong, is of a fine yellow, with a scarlet spot on the angle. The irides are yellow, and the naked margin of the eye is red. In winter the head is mottled with brown; and the young birds are mottled with light brown and white. All the parts of the plumage, except those which have been mentioned, are pure white. This is a very voracious bird, common in the northern seas, but rare in temperate latitudes. It sometimes visits Holland, and occasionally, but rarely, the British islands. It is described as a rock breeder, and the eggs are said to be greenish with black spots. It is in winter only that the burgomaster comes southward.

THE COMMON GULL (*L. canus*). This is the "wild sea-mew" of the British shores; and though it is not so landward as some of the others, it is found on most parts of our shores. It is about seventeen inches long, and thirty-six in the stretch of the wings, weighing about a pound. In the mature bird the back and scapulars are clear bluish grey, the primary quills black, and the secondaries grey, both with white spots on the tips. The young are subject to considerable changes of plumage in their successive years, and have been described as different species. The common gull is not a rock breeder, that is, it does not breed on the high cliffs, neither does it retire to the inland marshes, it breeds in concealed places along the shores. The eggs of the common gull are two in number, nearly the same size as those of a hen, but of an olive brown colour, marked with dark reddish blotches.

Common gulls are more completely scavengers of the sea than any others of the race which frequent the British shores. They do not refuse fish where such come in their way; but they watch more for the offal both of the land and of the sea. Near the estuaries of large rivers, especially that part of them where the water of the estuary meets the tide, and the animal remains produced by both are accumulated, they are found in greater numbers than almost anywhere else. They, however, distribute themselves generally along the beaches where there is an alternate covering and uncovering of the bottom to some

extent, because much more food is left for them there than where the shores are abrupt and precipitous. They also throng about the fishing villages, where there is usually a great deal of garbage, and where in consequence the common gulls are scarcely less familiar than poultry are in the inland villages. It appears also that they know instinctively where there is food for them on the land as well as where food is most abundant for them at sea; for though the times when they leave the shores *en masse* are understood to be those immediately preceding storms, yet they



Common Gull.

visit the fields at other times when bad weather certainly does not follow their appearance. They are tamed without much difficulty if supplied with plenty of food, which indeed is the case with all rapacious birds. In places near the sea tame ones are very useful in gardens, which they clear of slugs, worms, and other destructive little animals, very successfully; and in such places they will pay their regular visits to the sea, and return of their own accord. On emergency they can be made to eat grain; but that is not a favourite food with them. As is the habit of all gulls, they disgorge the contents of their stomachs when alarmed, and if the alarm is soon over they re-swallow. Whether this arises from the attacks made on them by the skuas it is impossible to say, because there are many sea birds which the skuas do not assail that have this habit. The petrels, for instance, always discharge a quantity of oil from their stomachs when they alight on a ship, or get into any other unusual situation. The flesh of these birds is not relished by most people; though some of those who reside near the sea consider it as not unpalatable after having been buried for four and twenty hours in fresh mould and then washed with vinegar.

KITTIWAKE GULL (*L. tridactylus*). This species is about the size of a pigeon; fifteen inches in length, about three feet in breadth, and more than half a pound in weight. The adults in their winter plumage have the upper parts bluish ash; the cheeks finely striated with black; the exterior quills bordered and terminated with the same; some black on the other quills; and all the rest of the body white. The bill is greenish yellow, and the feet olive brown. The leading character is the absence of a hind toe, in the place of which there is a mere clawless tubercle. The manners of these birds are peculiar. During the winter season they quit the shores, and are understood to disperse themselves over the northern seas, where their chief place of repose is on the ice. In spring they return in vast crowds to the rocky shores, where they breed in society, and literally encumber the air

with the multitude of their wings. On the cliffy parts of the east coast of Britain they are exceedingly numerous, so much so that any number either of the young ones or the old ones may be caught. They often sit so thick upon the rocks as to make these appear from a distance as if covered with snow. Their eggs are sought after with some avidity. They form nests constructed of coarse vegetable rubbish. The eggs are deposited in June, of a dingy greenish or whitish colour, marked with ash-coloured spots. When the young have left the nests, but are unable to fly, the shooting of them is a favourite sport in places where they are abundant. It is said of them, as it is of smoke-dried gannets, that they serve as a whet to the appetite; but an epicure who despatched a dozen upon one occasion, declared that he had no more appetite when he left off than when he began. They are more gentle in their manners, and as it is said more cleanly in their habits, than several of the other gulls, and instances have been known of their being tamed and evincing considerable affection for their masters. As they are among the most elevated breeders of all the gulls that frequent our shores, as their breeding rocks are usually of the most sublime description, and as the birds themselves are very numerous and by no means unhandsome, they are worthy of being studied with considerable attention.

THE SILVERY GULL (*L. argentatus*) is also called the herring gull. It has the feet of a pale flesh-colour; the irides and bill yellow, the latter with an orange spot on the angle. The upper part is bluish ash colour, and the quills dusky with black tips and some white spots on the back; the sexes are alike; the young have the bill of a horn colour, and the plumage mottled. The quills, in this young state, are dusky, without any black on the tips, or any white spots; and this plumage continues with very little alteration till the autumn of the second year. At that time, the feet acquire a reddish tint, and the bill becomes yellowish, the white is a little more pure, and the mottlings more of an ash colour. The dusky hue which, in the first plumage, marks the end of the tail, also begins to break with white at this moult. In the third autumn, the entire ash colour, and white, with the black on the tips of the quills, the white spots, the flesh-coloured feet, the yellow bill, and the straw-coloured eyes, are acquired, after which there is no farther change in the plumage. In the spring of each year, while the bird is advancing to maturity, there is some change in the plumage, but it is very slight, thereby proving that though the gulls do moult twice in the year, the grand moult is the autumnal one.

In all their plumages these gulls resort to the breeding grounds in the season; and as they do not congregate on those grounds at any other time of the year, there is little doubt that they breed before they assume the adult plumage. This is not uncommon among several genera of aquatic birds; and it used to be considered as a conclusive argument that the young and old were of different species. These birds are very abundant and very generally distributed over the shores, not only of the seas, but occasionally of the inland lakes. The greater number breed in the north, and form large nests of dry herbage on the ledges of the rocks. In the Orkney and Shetland islands their nests are exceedingly numerous; and when the herring fishing sets in they are such constant and such numerous attendants, ready to snatch

their share of the produce, that the fishermen can hardly drive them away. In winter they range considerably southward, and are not uncommon about some of the lakes in Switzerland, and farther east they reach the Black Sea, the Caspian, and the Mediterranean; while on the American shores they range as far southward as the West Indian islands. They get the name of herring gulls from the fact of their being seen in vast clouds hovering over the shoals of herrings, keeping up an incessant clamour, and as occasion offers darting down and twitehing out of the water those fishes which are near the surface. The flesh of this species is like that of most of the others, tough and unsavoury; but in those Catholic countries where it is found in the spring months, it is sold in the markets during Lent, as belonging to that class of birds which the pope and cardinals have seen meet in their wisdom to consider as fish, and allow to be eaten at all times when the flesh of such birds as are not *catholically* fish is prohibited under the most enduring penalty.

THE IVORY GULL (*L. eburneus*). The ivory gull is not only the most beautiful of the race, which are upon the whole rather handsome birds, but it is one of the most beautiful of sea-birds of whatever genus. It dwells in the extreme north, and does not quit the icy seas unless compelled by the violence of the weather. It appears only occasionally, and indeed as a straggler, on the most northerly islands belonging to Britain; for when driven southward by a winter of more than usual severity, it generally dashes onward to a greater distance. It occasionally alights in Holland, against which the winter winds from the polar sea set much more directly than they do against the British shores; and this is the reason why some polar birds which are rare with us, not only visit Holland regularly during the winter, but extend their migration up the valley of the Rhine as far as the Swiss lakes. With us the winds of the polar sea are turned by that general westerly or south-westerly current of air from the Atlantic, which, though it deprives us of the visits of those northern birds, gives us a much milder winter than the same latitudes of the continent. The length of the ivory gull is about twenty inches, the wings at least four feet, and the weight upwards of a pound. It is a bird of very elegant form, and perhaps there is no wing which cleaves the air with so much apparent ease as that of the ivory gull. Its colour is equally fine; it is of the most intense, and indeed indescribable white, far purer than the snows of its native regions; and nothing can exceed the compactness, the softness, and the exquisite gloss of its plumage. Though it is called the ivory gull, ivory, or indeed any other substance with which we are elsewhere acquainted, gives but a faint notion of its extreme purity. The feet are dark coloured, with the tarsi very stout, and the tibiæ feathered down to the tarsal joint, whereas in most of the other gulls there is a considerable extent of garter or naked space above this joint. This species is a marsh breeder, but breeds only in the extreme north, though there it is understood to range round the entire circumference, being as common between Asia and America, as it is between the latter continent and Europe. The young, of which the particulars are not very accurately known, are said to be mottled, with the black predominating in the first year, the white in the second, and acquiring their entire plumage in the third. It is probable that the appearance of some of those mottled

ones in places pretty far to the south, and also that some of the other gulls breeding southward in their immature plumage, may have led to the statement made by some of the continental ornithologists, that those gulls generally breed in the south of Europe. On the contrary, there is no reason to believe that a single nest of this species was ever found at any distance, if at all, without the polar circle. We might be prepared to expect this from the character of the feet, and also from the intense and unbroken whiteness of the colour. There is no southerly breeding gull, which has the feet feathered as these birds have, so as to endure the utmost severity of the winter's cold; and there is no gull which breeds in the south that has the plumage on the upper part so well suited for resisting alike the intense cold of the winter, and the continual action of the summer's sun. The nest is described as being on the ground, rudely constructed of vegetable remains, and the eggs as being four in number, and of a white colour.

LAUGHING GULL (*L. ridibundus*). This is a well-known species, and one which is very generally distributed. It is a bird distributed over many latitudes; and where there are marshes and pools, it resides as much of the year inland as on the sea. In summer, they collect in great numbers at favourite pools, especially those which contain islands, for the purpose of breeding; and at those times tadpoles and other productions of the water, together with worms, slugs, and other things which they pick up on the humid grounds, form the chief part of their subsistence. There are some places, both in England and in Scotland, where they still breed in great numbers, but more abundantly in the latter country. It is not easy to find out what circumstance may determine them in those parts where they have their nests; for there is a place in Strathmore, where pools of considerable extent, containing islands, many tufts of herbage, and to a great extent concealed by plantations, are very numerous, and, to all appearance, equally well adapted for the nesting places of those birds; but from time immemorial they have resorted to one particular part in such numbers, that, when they are alarmed, and take the wing, they appear from a distance as if it were the smoke rising from some mighty cauldron. But while they are thus abundant, to absolute crowding, on this particular pool, it is rarely that an individual is seen upon any of the neighbouring ones, and there never is a nest anywhere but at this one spot. This little lake is also far from being the most secluded; for one side of it is open to the cultivated fields, and not very far from human habitations. The birds, however, do not appear to heed this, for they alight near the houses with all the familiarity of magpies, and search the fields with the same assiduity as rooks. What may be the absolute quantity of specific service which they perform to the farmers, it is not easy to say, but it is a fact that, in that particular part of the country, the crops rarely, if ever, suffer from grubs or other ground insects. The birds, in their chosen habitation, are exceedingly noisy, and their cries are plaintive and wailing, but still they give a lively and picturesque effect; and it would be pleasant to see gull-pools in more parts of the country. The length of this species is about fifteen inches. The colour of the adult on the upper part is clear bluish ash. The head, the neck, and the wing-coverts, pure white; a black spot in front of the eyes, and another on the ear-coverts;

the outer edges of the quills and tail-feathers pure white, and the rest of the plumage white, with a rosy tinge. The young are mottled with brown and white, and have the tips of the quills and tail-feathers black. They pass however through two changes of colour, like the rest of the gulls, and therefore they are apt to be mistaken. These birds are easily domesticated, and are very ornamental as well as very serviceable in gardens, by clearing them of slugs, snails, worms, and other destroyers of vegetation, while the birds themselves injure nothing. It is understood, that contrary to the habit of the others, which admit of being thus kept, these birds do not require to visit the sea, though they must be fed artificially during the winter, an attention which their summer labours well repay. For winter food bread soaked in milk, or even in water, is very suitable for them; and they are not so voracious as the larger and more seaward gulls.

In the winter season they resort to the sea coast, but it appears to be chiefly from want of food; and though they can swim, and are often seen flying over the waters, watching for what the sea may cast up, yet they are as frequently met with in company with the running birds along the beaches. In the breeding season they are very plentiful in Cambridgeshire, and in some of the fens of Lincolnshire, resorting to the most swampy parts, along with ruffs, red-shanks, and snipes, whose nests are intermingled with the tall tufts of bog-grass. The gulls trample down the grass on the tops of the small insulated hillocks, and there form a flooring for their eggs, which are generally three or four in number, and usually of a deep olive colour, mottled with brown, and dusky blotches; but they are liable to vary. The females sit insulated on these about a foot or rather more above the swamp or surface of the water. Though thus seen at a considerable distance, they can better observe the approach of an enemy, and cannot be so easily shot. At the ceremonious feasts of the great in former times, the young gulls of this species were served up at the tables. There is considerable interest about these birds, as being one of the links which more immediately connect together the birds of the fresh waters and those of the sea.

ICELAND GULL (*L. Islandicus*). This species bears considerable resemblance to the burgomaster gull, formerly described, only it is smaller, more handsome in its form, proportionally longer in the wings, and altogether a more handsome and a more active bird. The colours are nearly the same in their distribution as those of the burgomaster, only the ash-colour on the back is paler and purer in the tint. The bill is much shorter and far more slender; the brown in the plumage of the young birds is also paler. This species does not appear even in the northern parts of the British islands, except as a rare winter visitant; and there is not much known of its manners in its native north. It is understood to be a rock breeder, and to nestle in the cliffs of Iceland, Jan Mayen, Spitzbergen, and Greenland.

SMALLER BLACK-BACKED GULL (*L. fuscus*). This species is sometimes called the herring gull, as well as the one already mentioned, but much darker; and there is one peculiar character by which it is distinguished from all the other gulls. Its feet are yellow, while in the others they are reddish or dark coloured. The upper parts are deep bluish grey, or slate black; the top of the head, the region of the eyes, the hind head,

and sides of the neck are white, streaked with lines of clear brown; the forehead, lower part of the back, tail, throat, and all the under parts are pure white; the closed wings extend two inches below the point of the tail, having the quills black with white tips, which form a spot on each side; the wing-coverts are also blackish with white tips; the irides and bill are yellow, the latter with a red spot on the angle of the lower mandible; and there is a red spot round the eyes. The bird is about twenty-two inches long, and weighs about as many ounces. The young have the upper parts mottled with brown and yellow, the bill blackish brown, and the feet dull yellow. These birds are very generally distributed over all the northern hemisphere, perhaps more so than any other of the gulls: their habits are very similar to those of the silvery gull; and like that they follow the shoals of herrings, and thus have an equal claim to the appellation of herring gulls. They breed in great numbers on some of the rocky shores of the British islands, more especially in Orkney and Shetland, but they are found on the Black Sea and the Caspian; and indeed generally wherever the place is adapted for gulls, even as far to the southward as the tropic, and occasionally within it.

THE BLACK-HEADED GULL (*L. atracillus*). This gull is about the same size as *ridibundus*, so that the two have often been confounded together; and one principal cause of the confusion appears to be, in the winter, the time when they are most seen by naturalists and describers, the characteristic differences of their plumage are considerably faded. This species has the bill and feet deep lake red, while those of the laughing gull are bright vermilion. The laughing gull also has white on the primary quills, while this bird has none; and the head of this one is far darker in the summer, being almost black. It is a very handsome bird, and the colours contrast strongly with each other; the cape upon the head, which extends a little way down the neck behind, is not absolutely black, but very deep lead-colour; the rest of the upper part is lead-colour, but not so dark as the cape; the quills are deep black, without any white, and the under part is altogether white, with very delicate reflections of rose-colour, which last fade off in a very short time after the bird is killed. In winter the forehead becomes white, with the exception of a few feathers at the base of the bill; the upper parts also become grey, with the exception of the primary quills, which merely change to a deep brown, differing little from black; in the winter plumage the under sides of the wings, as far as the primaries, also become silvery white, giving a remarkable appearance to the bird when it is seen from below, and, for that reason, this is the gull which is most generally introduced into paintings of the sea, whether those paintings happen otherwise to represent its localities or not. Its localities are, however, pretty extensive; for, though its head-quarters are in the North Seas in the breeding season, it finds its way as far as the Mediterranean in winter, and that in considerable numbers. It is a rock-breeding bird, forming its nest in the same way as the silvery gull, and indeed resembling that one very much in its general manners.

BROWN HEADED GULL (*L. capistratus*). The characteristic distinction of this species is a brown mark on the upper and hind part of the head. The bird is about fifteen or sixteen inches in length, but

it is much more slender in its form than the black-headed gull; the bill and feet are also much smaller than in that species, and indeed proportionally smaller than in any other of the gulls, so that they make a partial approach to those of the terns, and, as we might expect, there is a corresponding approach in the manners of the birds; for this gull is much more habitually seaward, captures its food more exclusively when on the wing, and, consequently, is less on the beaches, and feeds less upon garbage, than most of the genus. It ranges over the northern seas, and, though not common on our southern shores, it is by no means rare in the north. The bill, the feet, and toes, are brownish red, with the webs of the latter brown; the top of the head is purplish brown, terminating in black, but not extending so far over the head as the cap of the black-headed gull; there are also a few mottlings of white in the front margin of the cap; the neck, breast, and all the under parts, are pure white; the upper surface of the wings is pale greyish ash, and the under greyish white; the primary quills are white in the centres, margined with black, the black margins being broadest on the inner webs. Its colours are understood to be subject to the same winter changes as those of the other gulls, and the young to have the same kind of mottled plumage, only varying with the tint of the old birds, for the darker mottlings of the young are always paler in those species which have the entire colour paler in the old birds; and this is one means by which, when they are all mottled, the young of the different species may be distinguished from each other. From the lightness of its form, the softness of its colours, its habitual motion on the wing, and its frequently twitching down to snatch from the waters those small substances on which it feeds, this is far from being the least interesting of the gulls.

SABINE'S GULL (*L. Sabini*). This bird is an inhabitant of the extreme north, and has the legs feathered, though not to the tarsal joint, as the ivory gull has. Its structure, however, indicates a far northern bird, the length of the tarsus being an inch and a half, and the tibia feathered as already stated. These are small gulls, breeding in the dreary islands on the shores of Greenland, and associating with terns and other birds. They are described as picking up the principal part of their food along the water-line on the beach, and seldom fishing. They live in society, numbers of them breeding at the same place, and they defend their young with great resolution. The eggs are two in number, placed on the bare ground near the margin of the waters, and not high upon the rocks. These eggs are about an inch and a half in length, rather rounded at the ends, olive in the ground colour, but thickly blotched over with brown. They are hatched about the beginning of July, and the pairs are remarkably attached to each other. No account of a very satisfactory nature has yet been obtained of the changes to which they are subject in the winter.

LITTLE GULL (*L. minutus*). This is by much the smallest of all the gulls, being only about two inches in length, but it is a well winged little bird, and very discursive over the sea. It does not come to the British islands except as an occasional visiter. It appears also to be more a Siberian bird than an inhabitant of the Atlantic seas. The plumage of the adult birds, in the winter, is bright bluish ash on the upper part; hind head, nape, and patch on the eye

and ear, dark ash; quills bluish, with a large white bar on the tips; coverts of the wings, and all the under parts, pure white; bill and irides brown; feet red; the wings extend an inch beyond the point of the tail. In the summer plumage, in which it has been described as the Siberian gull, it has a black cap on the head, and a spot of the same colour behind the eye, and the wings ash-colour, with white tips. The young are mottled.

ASH-HEADED GULL (*L. cirrocephalus*). This is described as a Brazilian species, but, in all probability, it ranges over great part of the Atlantic. It is fourteen inches in length. The bill and feet are red; the upper parts, and the throat and neck, are bluish ash; the forehead white; the first seven quills of the wings black, with white at the bases, and when the wings are closed, the black feathers project beyond the coverts, forming a spot on each side; the coverts, the tail-feathers, and all the under parts of the body, are pure white.

Many other species and varieties have been described as inhabiting the seas of different parts of the world, but little is known of them farther than has been obtained from the inspection of a few museum specimens; and it does not appear that there is any great difference of habit among them which may not be found in one or another of the species that have been enumerated. At all events, these include the whole that have hitherto visited the British shores either habitually or occasionally. We have been somewhat minute in our notice of them, as gulls are birds which are highly characteristic of the sea, and peculiarly attractive to those who only occasionally see the great waters. When a "sea-bird" is mentioned by way of eminence, a gull, a tern, or a petrel, is always meant.

SKUAS (*Lestris*). Though, in the northern parts of these islands, the places where the people are most familiar with sea birds, and most interested in them, the members of this genus are called gulls, and though the older naturalists included them in the genus *Larus*, yet they are quite distinct both in their structure and their habits; and we have introduced them here because it will not only save repetition, but enable our readers to see more clearly the relation between them, which is in some respects a curious one.

We mentioned that the gull may be considered as a sort of vulture of the sea, and partakes of the voracity and cowardly, or rather inoffensive, character of the land vultures, although the great black-backed gull is alleged to take advantage of the weakness of living prey, in the same way as is said of the condor. There is another point of resemblance between them which is perhaps as striking, and that is the great length and curvature of the wings, both in the gulls and the vultures, which appear to fit them for floating long upon the wing, and seeing their prey at great distances.

Now as the gulls are thus, to some extent, the vultures of the sea, so the skuas may be regarded as to a similar extent the eagles and hawks of the same. They are strong, bold, and plundering birds; and besides their peculiar mode of plundering the gulls, to be hereafter noticed, they rob other birds of their eggs, and commit various depredations, which conduct on their part has, not inappropriately, gotten them the generic name of *Lestri*, or robbers. In their breeding places, which are in countries far to the north, rarely if ever to the southward of the Orkney

islands, the larger ones repel all intruders with great resolution, and are formidable even to man himself. In this they differ from all other sea birds, many of which are very clamorous when their nesting places are invaded, as for instance gannets, cormorants, and all the species of rock-building gulls. With these, however, it is only clamour; but the larger skuas can make formidable attacks, and their numbers overcome the sea eagles themselves. But while they are thus bold in the defence of their homes and broods, they are not rapacious against other birds. They partake perhaps fully more of the vulture than of the eagle, and the larger refuse of the sea, the dead bodies of seals and whales, and all other unclean things which float upon the ocean, are food for the skuas.

The generic characters are: the bill of mean length, stout, hard, cylindrical, with sharp cutting edges, compressed, curved, and hooked at the tip; the base of the upper mandible covered with a cere, as in the birds of prey; but the lower mandible with a salient angle at the middle of its length, as in the gulls; the nostrils situated near the point of the bill, diagonal, straight, and partially closed with membrane; the tarsi small, and the legs naked to some distance above the knee; the toes three to the front and one to the rear, the former completely webbed, the latter almost entirely free, and all the four furnished with large and long crooked claws, the hind toe much smaller than the other three; the tail slightly rounded, and with the two middle feathers rather longer than the rest; the wings of mean length, and the first quill the longest in the wing; the body very compact and robust, much more so than that of any other sea bird, and the colours, in some of the species at least, partaking of the reddish and blackish browns which are so prevalent in land birds of prey.

The most remarkable character of the skuas is the habit from which they have obtained the name of *Lestris*, and which has been very properly substituted for the old name of *Stercorarius*. The last of these was given from the foolish belief that these birds fed upon the "mutings" of other sea birds, especially the gulls, whereas it is the food from the stomach, and not the refuse after the purposes of the other bird have been served, which is the object of the *Lestri*. They must be considered as birds of prey as well as the land *Accipitres*; but there is this difference between them, that while land accipitres are invariably murderers, the skuas are simply robbers; and, less daring, as one would say, than the others as well as less bloody, they do not hesitate to join the more cowardly craft of stealing with the more daring one of open robbery. The flight of these birds is by no means so gliding and apparently easy as that of the gulls, although even then it has an appearance of more power about it. The gull glides away, with soft wing, as if it were a mere passenger upon its organs of flight. The skua bounds and bounces with a jerking and uneven flight, as if it had other work to do in the air besides locomotion; and it has other work there, for the air is the scene of its robberies. It is no unamusing sight to observe the gulls and skuas, especially in the currents among the northern islands, where herrings and the fry of fishes are caught in the turbulent water, and brought near the surface in great numbers. The gulls whiten the air with their numbers, make the whole concave of heaven ring with their wailing cries, and plunging down catch fish after fish with great rapidity and apparent ease. The

darker coloured skuas are in the meantime hovering about, keeping a steady eye upon such of the gulls as have been successful in their fishing; but keeping the upper part of the sky, and not themselves condescending to come down for the purpose of capturing a single fish. They leave this part of the business to the gulls; and when a gull has got its load, for it can swallow a considerable quantity, and rises to the upper part with heavier flight than usual, in order to bear off the produce of its industry to its mate or its brood, the war cry of the skua is soon heard and immediately it dashes at the gull, repeating again its summons to "stand and deliver." If the summons is not answered the skua strikes at the gull, and most likely tumbles it headlong by the force of the stroke, though without doing it any mortal or material injury. But this seldom happens, for the terror of the gull makes it discharge the contents of its stomach the moment that the skua comes driving at it; and the instant that this is done the skua leaves the gull, and plunging down with great rapidity catches the prize before it reaches the water. This habit of taking the prey from the preyer is not wholly confined to the skuas; at least the American ornithologists describe the whiteheaded eagle of that country as hovering about and treating the osprey in this manner, not making the osprey disgorge the morsel which it has swallowed, but compelling it to drop the fish which it is bearing off in its talons. It seems that this habit, whether it belongs to eagle or to skua, requires as much courage on the part of the bird practising it as the habit of attacking birds in order to kill them. Indeed it requires more, for most of the birds of prey have some particular art or stratagem by means of which they come upon their prey, and despatch it without giving it time to defend itself; and it is well known that when another bird can stand upon the defensive, a bird of prey will sneak off in a cowardly manner. Thus, however fond the common kite is of chickens, it dares not approach a brood hen; and even the golden eagle itself, if it ventures to stoop at a raven, turns craven and is off if it once perceives that the eye of the raven is upon it. Hence it should seem that it requires greater courage in a bird to become a robber than a murderer, and accordingly the more powerful skuas are among the most daring and courageous of the feathered race, and may be said to be in their own localities the monarchs of the sky.

There are several species of this genus, some of which generally, and others occasionally, visit the northern isles, and some of the remote coasts of Scotland; and stragglers also occasionally find their way to the English shores, especially at those times when pilchards, sprats, and other small fishes, are shoaling near the land. Their chief places, however, are those at which the gulls congregate in the greatest numbers; though even at these places, the skuas have their peculiar nesting grounds, and mix with the gulls only when the latter are engaged in fishing.

COMMON SKUA (*L. catarractes*). This is the largest species of the genus, and the one which is most abundant and best known upon the British shores. It is a large and powerful bird, not much inferior to the eagles in size and strength. The length is about two feet or upwards, the neck is short and strong, and the whole body has a firm appearance. The extent of the wings is between four and five feet, and the weight of the bird is about three pounds. The basal part of the bill has the form of that of the gulls, only

the cere reaches as far as the nostrils ; and the portion to the front of these is very hard and strong, resembling in shape the tip of the bill of a hawk or eagle. It should seem that the cere has something to do with the production of a bill of more than ordinary strength and firmness of substance, at least all bills which are furnished with regular ceres, have those properties in a higher degree than those which are not so furnished.

The whole upper part of this bird is deep brown, with dull rust colour on the margins of the feathers, by means of which each feather is distinctly made out, something similar to what is the case in birds of prey. The colour on the under part is the same but lighter ; and the head and throat are marked with streaks of greyish ash. The tips of the secondary quills, and the bases and shafts of the tail-feathers, are white, but the remainder of these feathers are deep brown. The tarsi and toes are covered with black scales, which are placed shield-wise rather than articulated ; the claws are large and crooked, especially those on the inner toes.

These birds are natives of the high latitudes of both hemispheres, though we believe the only part of the south where they have been met with is on the islands to the southward of America. In the north they are pretty generally distributed, though they are rarely seen to the southward of the Orkney islands, and are not very common even there. They are more abundant in Shetland, and still more so on the coast of Norway, in the Faroe islands and in Iceland. Where they associate in numbers they commit great depredations on the nests of the bank-building birds, and are sometimes accused of attacking the birds themselves. Indeed in Orkney and Shetland, where they are called sea eagles, and various other formidable names, they are accused of attacking lambs. It may be that they attack those animals ; and they no doubt feed very readily upon the dead carcasses of such as perish in the pastures ; but that a skua can carry off any thing in its claws, strong and crooked as they are, is impossible, because those claws have nothing against which they can act, the hind one being too small and feeble for this purpose ; and in birds which carry their prey with the feet, the hind toe and claw are always strong, and when the foot is more exclusively a carrying than a killing foot, the outer front toe is reversible. The tarsi and feet altogether of the skua are too feeble for enabling it to use its crooked claws in any very offensive manner ; and the muscles with which the thighs and legs are furnished are comparatively trifling, the strength of the bird is in the wings and the neck ; and the most obvious use of the crooked claws is that of enabling it to hold on upon the oily and slippery carcasses of dead whales and other carrion, upon which it feeds voraciously.

We believe there is no well authenticated instance of a skua attacking any large and living bird, or other animal, for the purpose of making a meal of it ; and indeed its bill is not adapted for cutting or tearing recent flesh. Hence the most rational theory of its economy in the north is that which regards it as a protector of the flocks and not a destroyer. There is no question that the eagles and falcons, and occasionally the larger owls, of those remote islands prey upon the young and the diseased of the sheep ; but if the skuas take up their nesting place in the neighbourhood (and they are social in their breeding places),

those predatory birds dare not appear within some distance. The skuas breed in the moor rather than the marsh ; and some of them are on the alert at all times, ready to give notice of the appearance of an enemy. No sooner is the signal of danger given, than it is answered by the sound of a hundred wings ; and the skuas instantly surround the intruder, and drive at him on all sides. Theirs is a warfare for which birds of prey are not prepared ; and indeed birds of prey are no soldiers : the skuas shoot themselves like javelins at the enemy, and from their weight, the strength of their make, the firmness of their bill, and the rapidity of their flight, a single stroke taking effect would finish an eagle. Even man himself does not invade the habitations of those birds without danger, because they assail him as readily as any other enemy ; and it is customary to guard against them by a sharp-pointed stick, or one with an iron spike rising above the head, upon which the birds are said sometimes to descend and transfix themselves.

Though these birds assemble in considerable numbers upon the breeding grounds, they are understood to be also always in pairs ; and when the young are full grown, and begin to disperse themselves over the ocean, it is understood that they also take their departure in pairs. Not the skuas only, but also the common gulls, and most sea birds which crowd to the rocks, the marshes, and the moors during the breeding time, disperse themselves over the sea toward the close of summer, and many of them go to considerable distances. It has often been a matter of speculation where or how they procure food on those long marine journeys ; but there is, altogether independent of the fishes, a harvest of the sea at that particular season, and a harvest arising from the birds themselves ; so that at this season the birds so far imitate their neighbours under the water, the fishes, that they " enjoy themselves in eating one another," with only this difference, that these fishes eat live fish, whereas the birds eat dead birds. It will be recollected that the whole year's brood of terns, petrels, and all other long-winged birds, disperse themselves over the sea at this season of the year, and that very many of them do so before they have acquired the average strength of their species. Multitudes of these become exhausted, tumble into the water, die there, and supply food for the rest ; and the common skua, being the most powerful and the most daring of the sea birds, of course comes in for the lion's share.

POMARINE SKUA (*L. pomarinus*). This species is the next in size and power to the common skua, and it is a more northerly inhabitant. As a British bird it is only a straggler ; but it straggles into the southern parts of the country as well as the northern. In the winter of 1831, a live specimen was sent to the Zoological Society of London from Devonshire, where it was taken, very much exhausted, apparently with the fatigue of a long journey. The upper parts of this species are of a uniform deep brown ; the feathers of the nape are long and pointed, like those on the necks of the eagles, and they are bordered with a bright yellow. The throat, the hind part of the neck and the belly are white ; there is a large band of brown spots on the breast, and similar spots on the flanks and under tail-coverts ; the bill is of an olive colour, with a black tip ; the irides are yellowish, and the feet black. The length of the bird is about seventeen inches ; but the two middle feathers of the tail,

which are slender and pointed, extend about three inches more. These are the colours of the mature bird. After the second month the whole plumage on the upper part is brown; the produced feathers on the neck brownish yellow; and those in the tail considerably shorter than in the mature bird. In the first plumage the head and nape are dull brown, with lighter brown borders to the feathers; there is a black patch in front of the eyes; the back, the scapulars, and the wing-coverts are brown, bordered with deep russet and striated dark lines; the breast, the belly, and the flanks are brownish ash, marked with zig-zags of russet; the vent, rump and tail-coverts are marked with large bands of russet and dusky; the bill is greenish blue, with the point black; the feet are bluish ash, with black webs; and the middle feathers of the tail are not above half an inch longer than the others.

The proper home of this species is the seas of North America; but the fact of its being found in Britain, however rarely, shows that it is a bird of very powerful wing, and disursive in its habits. In its general manners it resembles the common skua, but it is a less powerful bird, and therefore does not so readily attack the larger gulls. It is, however, a bird of more light and elegant form, and, if not more rapid in short flight, at least capable of remaining longer on the wing, and thus ranging farther seaward. The smaller gulls and the terns seem to be the birds which it principally attacks; and there is no doubt that the specimens which straggle to the European shores overfly themselves in their pursuit of these, and thus are unable to return to their native localities. This skua appears to stand in nearly the same relation to the common skua as the more powerful falcons stand in to the eagles; and in its plumage, and the form of its body, though not in its bill and its feet, it bears no inconsiderable resemblance to those falcons. Nor is it unworthy of remark and inquiry into the relations, that there should be a correspondence between the different species of those sea-birds which are unquestionably the most bold and predacious in their way, and the most bold and predacious of the land birds. This is one point upon which the analogy of the sea and the land might be studied to very considerable advantage; and the result of such a study would be the discovery of how far those two great divisions of the earth's surface tell upon each other, through the medium of the air, in so far as animal life is concerned.

RICHARDSON'S SKUA (*L. Richardsonii*). This species is, next to the common skua, the best known in the British seas of all the genus, and, indeed, it is found farther to the south than that one. As has been the case with many of our sea-birds, there have been very considerable mistakes and blunders concerning this one. It is the arctic gull of many describers, and the arctic skua of some who approximate to a little more accuracy, but still it is not, in reality, either the one or the other. It resembles the common gulls more than either of the former species, having the plumage less decided, and altogether less of a hawk-like appearance. The head is blackish brown, with the dark colour extending on the cheek a little below the eyes; the general colour of the upper part is brown, not so deep as in the larger skuas, and with a trace of ash-colour in it; the sides of the neck are buff; the throat, and all the under part, white, but gradually passing into greyish ash-

colour toward the vent-feathers; the bill is bluish ash, with the cere whitish, and the feet are the same colour as the bill; the webs are much larger than in the two former species, and the whole character of the bird is more that of a swimmer; the wings are very long, and the two middle feathers of the tail are still farther produced than in the pomarine skua; the entire length of the bird, tail and all, is one foot nine inches, but the nine inches are occupied by the tail, and three of these by the produced feathers in the middle. The young of these birds are of a brown colour, and have the tail-feathers much shorter than the mature ones. As has been said, they are not rare on the northern shores of Britain, and they extend as far to the southward as those of Yorkshire. They come to the British shores in April or May, along with the terns and the smaller gulls, upon which chiefly they levy their contributions. They are understood to pair for life; and they breed in this country, taking their departure in August or September, when the other sea-birds break up their summer encampments. They are not so exclusively sea-birds as the common skuas, but occasionally range inland, feeding upon worms, molluscons animals, and other small productions of the land. On the shores, however, they are very much given to plundering the smaller gulls, which they do with as much vigour and success as their more powerful congeners plunder the large ones. They are very plentiful in the western islands, where they make their nests in bogs and marshes, concealing them in tufts of herbage. The eggs are described as being only two in number, ash-coloured in the ground, and mottled with black. Altogether, these are very interesting birds, not only as they are the most abundant British species, but as they combine, to a certain extent, the appearances and the habits both of the skuas and the gulls.

ARCTIC SKUA (*L. parasiticus*). This is the species with which the preceding one has been confounded, and the description of the one has been so blended with that of the other, as to occasion no little confusion. This one does breed occasionally in some of the remoter parts of the British islands, but it is rare compared with the former. It is by much the lightest and most handsome bird of the whole genus, and is at the same time the smallest. Its length is about the same as the last, but the tail is in this one twelve inches in length, leaving only nine for the body, and the bird is not above one-third of the weight. The head is furnished with a cap of dark blackish brown, which does not reach below the eyes; the general colour on the upper part is clear brownish ash, the quills and tail-feathers being darker; all the under parts, together with the region of the eyes, the neck, and the breast, are white, but waved with ash-colour on the flanks; the two produced feathers of the tail are sometimes five or six inches longer than the rest, and they are remarkably slender and pointed, which gives the tail a very peculiar appearance. This lengthening of the tail-feathers gives the birds something the appearance of terns when they are on the wing; and, as the wings themselves are very much pointed, as well as very long, they can sport about in the air with all the activity and evolutions of the swallow tribe. They are indeed the swiftest fliers in all the genus, and their rapidity of motion makes up in some measure for their inferior strength. They never venture to attack the larger gulls, but they are very vigilant in levying their imposts on the smaller

ones and the terns; and, as the smaller gulls, and especially the terns, are more rapid fliers than the large gulls, the arctic skuas are more rapid in proportion. Their proper localities are more northerly than those of the species with which they have been confounded, and, generally speaking, they do not come so far inland. They are birds of pleasing colours, handsome form, and rapid flight, and, altogether, they possess no inconsiderable degree of interest. Indeed, though the skuas have been most unjustly accused of being fouler feeders than any other of the feathered race, there are perhaps no birds better defined as a genus, more characteristic of the localities which they frequent, and, altogether, more interesting to the student of nature. Majestic as the sea is in its own phenomena, and restless as are its waters, the sea would lose much of its interest, were it not for the countless myriads of birds which sport over its surface, and feed upon its produce. Any one who has visited a favourite resort of sea-birds, while they were there, and again after they had quitted, and spread themselves over the ocean, can tell how desolate those places are, notwithstanding their majesty as a part of nature in repose, when they are without their gulls and their skuas.

GULO—Glutton. A genus of mammalia, belonging to Cuvier's great order, *Carnassier*, or those which feed upon animal substances, and to the third division of that order, *Carnivora*, or those which are more or less in the habit of killing warm-blooded animals for the purpose of feeding on their flesh. Of carnivorous animals, all the genus *Gulo* belong to the plantigrade division, or those which walk on the entire length of the tarsus, or sole of the foot. Animals which have this structure, have of course the command of one joint less of the leg in the air, than those which walk on the toes; and, therefore, their walking march is much slower: generally speaking, too, they are lower on the legs, and from applying the whole length of the legs to the ground, they seem lower than they are in reality. These circumstances are, however, attended with a firmness upon the legs in those animals, which is perhaps peculiar to them; and many of them have the spine very long and elastic, so that they combine the motion of a leaping animal with the action of the spine of a snake, and thus advance with far greater celerity than from their apparently short legs one would be apt to suppose. See **PLANTIGRADA**.

Zoologists have sometimes been at a loss in what part of the system to class the animals composing the genus *gulo*. Some have arranged them with the weasel tribe, others with the bears, and others again with the badgers; but though they have some characters in common with the bears, and also with the badgers, they are clearly separated from the weasel family, because that family are digitigrade, or walk on the toes, and are consequently far swifter in their movements than animals of the genus *gulo*. Cuvier places them, and we think with great judgment, the very last of the plantigrade division, by which means they are brought next to the martens, with which the digitigrade division begins; and in this arrangement they immediately follow the badgers. This genus, in so far as we are acquainted with it, for the habits of some of the species are not a little obscure, and they all dwell in wild places, remote from the habitations of men, and live in comparative concealment, may be said to partake a little of the form of the badger, and of the disposition of the martens; for they are

certainly the most decidedly carnivorous of all the plantigrade animals.

Their generic characters are: three false grinders in each side of the upper jaw, and four in each side of the under, situated in front of one carnivorous tooth, which has very trenchant points, and is well made out. Behind this there is only one small tuberculated tooth in each side of each jaw. This is exactly the mouth of the martens; and it indicates as great a power of tearing flesh, and as little adaptation for living upon insects or vegetable matter, as is to be found in the whole order of carnivorous animals.

Notwithstanding this carnivorous disposition (for in wild animals, that is, in animals in a state of nature, "As is the structure so is the habit," is a maxim which never fails), these animals seem dull and heavy, especially in their motions; and though many of them can, by the help of their flexible spine, leap a considerable way, there is none of them that can pursue its prey successfully in regular chase. They are generally animals with a large head, and the jaws not greatly produced, so that they are remarkable rather for holding on by the staunchness of their bite, than for giving a powerful snap, as is done by long-muzzled animals. The ears of this genus are, in general, but little developed, which leads to the conclusion that they find their prey by the sight and not by hearing. The tail is short in the more characteristic species, but longer in some of the others; and instead of the pouch under the tail, which in the badger secretes so offensive an odour, they have a simple fold of the skin. All their feet are furnished with five toes, and those toes in general with strong, crooked, and sharp-pointed claws. Those claws are not decidedly prehensile, like the claws of the cat tribe; but still some species at least can readily climb trees by means of them, and also keep their hold upon the backs of their larger prey, in the same manner as is done by lions and other members of the cat family. It is to be understood when we speak of a plantigrade animal, that the expression applies more particularly to the hind feet, or at all events, that the elbow joint in the fore-feet acts in the same manner as the tarsal joint in the hind ones, and that thus, though such animals as the genus *gulo* are ungainly walkers, the whole of the hind legs come well into play when they leap. These animals are remarkable for the fineness and the thickness of their fur; and some of them have, in respect of colour, a different arrangement from almost every known species, not only of mammalia, but of warm-blooded animals generally. Their colours are very often much darker on the under part than on the upper, whereas in every other case of difference in the colour, of the two the upper part is invariably the darker. This remark applies, of course, to the unbroken colours in a state of nature, and not to those variations which take place in domestic animals. There are several species of this genus, some of which occur in both continents, and some only in one, some in the extreme polar latitudes, and some in tropical countries, and there are instances in which the number of false grinders differs from the typical number above stated, and where the food also varies from that of the more typical species; but the characteristic ones are inhabitants of the north, both of the eastern continent and of America.

COMMON GLUTTON (*G. vulgaris*). In this species the length from the nose to the tail is about twenty-

eight inches, and from the trunk of the tail about seven inches and a half. The tail has a covering of long and thick hairs, which are of a reddish colour, having a black tip. The hairs on the back, head, and belly, are of the same colours, but of a much finer and softer texture. The throat is whitish, marked with black. Along the sides, from the shoulder to the tail, is a broad band of ferruginous hue. It is to be observed, however, that the animal varies considerably in colour; and in consequence of this variation they have been multiplied into several species, or at all events several varieties. Generally speaking, those which inhabit the close forests are darker in the colours than those which inhabit more open places; and this is what one would naturally be led to expect from the fact that the upper part, which is most exposed to the light, is generally paler than the under. It seems also that in America they are upon the whole paler in the colours than in Europe. This may arise from the American forests not being in general so close as those of northern Europe. But in America they vary considerably, and there is little doubt that the paler ones, which are known and described under the name of *Wolverine*, are nothing more than coloured varieties, to which the name of a very ridiculous imaginary animal, invented by the heralds, has been applied.

The common glutton is an inhabitant of all the arctic regions, Scandinavia, Canada, the northern parts of the United States, and, probably, Siberia, and the central and western parts of polar America. But though an animal of the extreme north, and unknown in any country considered as temperate, it does not hibernate, but is on the alert, and feeds as rapaciously during the winter as at any other time.

The name glutton was originally applied to this species in consequence of the voracity of its appetite; and though the old accounts of it are very greatly, and even ludicrously, exaggerated, yet there is no question that it can eat more, and probably more frequently, than any other animal of its size. The old stories went so far as to say that it sometimes gorged itself until not the stomach, but the external skin actually split open; and that, to prevent this catastrophe, it used to rub itself between two close growing trees, and thereby both promote digestion, and also get rid of the superabundant part of the food. This, of course, is highly absurd; because there is no animal in a state of nature which takes its natural food to a single ounce or atom beyond the quantity at which that food ceases to be wholesome; and though man, acting upon his own fallible propensities, and not upon the pure instinct of nature, may sometimes die of surfeit, this is a case which is quite unknown among the other animals. It is true that many of those species which, from their own peculiar nature and that of their food, are subjected to long periods of abstinence, fall into a state of stupor after a hearty meal; but this is not disease; and though the animal is thereby rendered incapable of active exertion for a time, it suffers no injury. In fact, after it has fed heartily it has no use for exertion until it is again hungry; and therefore it is a wise provision of nature that it should at those times remain still, and not alarm those animals upon which it feeds, and of which it is not the destroyer but the regulator.

The glutton is scarcely capable of catching any animal by pursuit, and therefore its habits are those of a liar in wait. Small mammalia and birds are under-

stood to be its ordinary fare; but in cases of emergency, it can prey upon larger animals, upon the different species of arctic deer, and even on the reindeer itself. Indeed, from its mode of attack, the size and strength of its prey do not appear to be matters of very material consequence. The glutton is, as we have said, well adapted for climbing trees, and its length and lowness, the extent of its feet, and the sharpness of its claws, enable it to hold on upon a branch, crouching so that it is not easily seen. The deer and other animals usually have tracts or passages through the thick parts of the wild forest; and so prone are all animals which feed on vegetables to follow in each other's footsteps, that sheep, horses, and rabbits, and even mice, are road makers, although the surface upon which they make the road, by successively following each other, may be quite level and uniform. The same instinct which leads the glutton to prey upon those animals leads it to the track along which they pass; and, getting into a branch which overhangs this track, it drops down on the shoulders of the passing animal, where it keeps a firm hold with its sharp claws, tearing and lacerating all the while with its very formidable teeth, at that part where the neck joins the shoulders. The pain produced induces the animal to set off at great speed, and the excitement increases the discharge of blood from the wounded part, so that, as is the case with the larger prey of the lion, the strength and fleetness of the animal contribute to its destruction; and the glutton continues in its place of attack until the prey tumbles down completely exhausted, and incapable of making any farther resistance.

But notwithstanding the voracity of this animal, and the stratagems to which it has recourse to compensate its want of swiftness, the glutton is capable of being tamed; and instances are mentioned in which, when properly fed, it has shown not only no disposition to ferocity, but seemed grateful for the food given it and the attention paid it. We might expect this; for there is no animal more ferocious than the dog, even in a semi-barbarous state. A tame one, which was kept at Dresden, and exhibited as a performer of tricks, would eat thirteen pounds of flesh in a day without appearing to be satisfied. That which Buffon possessed, on the contrary, consumed only four pounds of meat daily; and another, which belonged to the Hudson's Bay Company, was contented with the ordinary allowance of a mastiff dog. This is the only species, at least the only well made out one, which is met with in the arctic countries.

GRISON (*G. vittatus*). This animal is a little larger than the European weasel; and it is the one which is most remarkable for light colour on the upper, and dark on the under side of the body. The upper part of the body and tail are covered with hair alternately annulated with black and white, but which, from the mixture, produce a grey appearance, much in the same way as grey is produced in the badgers. The whole of the under part of the body and the inside of the legs are black. A white line on each side of the head passes above the eye to the ear, below which the head is black, but above it is white. The ears, which are of a white colour, are very small, and have no produced lobe; the tongue is rough; the pupils of the eyes are round, indicating a day preyer; and the sides of the mouth are furnished with small mustachios. The fur is of two sorts, one short and woolly, and concealed among the roots of the long silky hair,

which last gives the animal its colours, as above stated. The toes are large, and half way united by membranes. The tail, which is one-third the length of the body, is borne horizontally. The animal conceals itself in holes, and when attacked gives out a strong and most offensive smell. This proceeds from a fluid like honey, secreted by two glands near the anus; and the possession of these is of itself perhaps enough for a specific and even a generic distinction.

It is found only in South America; and the names of different European animals have been, not very judiciously, applied to it by different authors. D'Azzara calls it the "little ferret;" Buffon, the "Guiana pole-cat;" and Thunberg, the "Brazilian bear;"—all of which names are liable to mislead. It is exceedingly ferocious in a state of nature, a very hearty feeder withal, and as it is quick in its motions, that is, on the alert and can leap well, it commits great depredations upon the smaller mammalia and the birds of that country which it inhabits. Its distribution throughout South America is very general, and it is far from rare in any country. It can be tamed; and if properly fed its manners are gentle, but if it is allowed to become hungry it does not hesitate to attack any animal which it can master that comes within its reach. One which was in the possession of M. F. Cuvier had been tamed—at least, to a certain degree. It did not appear to distinguish one person from another, was very fond of play, and for that purpose all comers were alike to it. It seemed to derive pleasure from being stroked down the back with the hand. When invited to play, it would turn over, return with its paws the caresses addressed to it, bite gently the fingers it could seize, but never so as to hurt or wound them. One might almost have imagined that it felt the degree of resistance which the skin was capable of making, and proportioned the force of its bite accordingly, when it meant only to express its joy. It knew the fingers of a person without seeing them. Notwithstanding, this animal preserved its ferocity for all those living beings that could become its prey. Even when satiated with food, it testified, in a lively manner, the desire of getting possession of such animals. One day it broke the bars of its cage to attack an animal that was within reach, which it mortally wounded. When it could catch a bird it killed it directly, and kept it by for provision, as was its custom to do with the meat it received, after having satisfied its appetite.

TAIRA (*G. barbarus*). This animal inhabits the same countries with the grison, which it resembles in manners but is larger in size. It is found not only in the South American continent, but also in the West Indian islands, where it is called the greater weasel. The general fur all over the body is black, or brownish black; but the head and neck are often more or less grey, and there is a large patch of white on the throat and fore part of the neck. The ears are very short and white; the length, exclusive of the tail, is about two feet; and the tail, which is covered with longer hair near the body, is about fifteen inches in length. The feet have five toes each, and the form is rather peculiar. The middle toe and the one on each side of it are united together as far as the claws, while the outer and inner ones, which are very short, are detached at the articulation of the others. This animal, as it is more powerful, is described as being proportionably more predatory than the grison. Like that it is a burrowing animal, and as it lives in a state of

still greater concealment than its congener, its manners are not much known. From the following notice in the proceedings of the Zoological Society's Scientific Committee, May 31, it should seem that there are at least several coloured varieties of this animal, if not several distinct species, to be met with in South America. "A living individual," says the report, "apparently referable to the *Gulo barbarus*, Linnæus, was exhibited. It was presented to the Society by Edmonstone Hodgkinson, Esq., of Trinidad, who describes it as being 'playful and gentle, although easily excited, and very voracious. It is exceedingly strong, as is indicated by its shape, and it has the same antipathy to water as a cat.'" Mr. Hodgkinson suspects that it is a native of Peru. He obtained it in Venezuela, where it was presented to him by the president, General Paez. The name he received with it was "the *Guache*;" but this appellation, it was observed by Mr. Bennet, was probably erroneously applied to the present animal, belonging rather to the *Coati*, the orthography of which is variously given, as *Coati*, *Conati*, *Quasje*, *Quachi*, and *Guachi*. The latter term occurs in the "Personal Narrative" of the Baron Von Humboldt, where it evidently refers to a nocturnal species of *Nasua*.

The form and general appearance of the animal were remarked to be altogether those of a *Mustela*, to which genus it is probable that it should be referred, together with the typical *Gulo barbarus*. A specimen of the latter was placed on the table, from which the living animal was shown to differ, by the absence of the large yellow spot beneath the neck: a remarkable distinction in this group, but on the occurrence of which, unless confirmed by several specimens, it was considered improper to propose regarding it as a distinct species.

ORIENTAL GLUTTON (*G. Orientalis*) is a native of the mountains of Java, and probably also of other parts of the East. It was first noticed by Dr. Horsfield, but does not appear to be by any means uncommon in that country. The natives call it *Nyentek*. In size it is rather smaller than the pole-cat of Europe, and it is much more slender in the body than the glutton. The fur is thick, consisting of long hairs, closely arranged, silky at the base, of a brown colour, and somewhat glossy, slightly tinged with reddish brown. In some lights it appears diversified with a greyish and tawny colour. This fur covers almost the entire body and head, and the whole of the tail and extremities. The sides of the head, neck, throat, breast, and a broad patch on the top of the head, which passes gradually, decreasing in breadth, to the middle of the back, are white, with an obscure tint of cream colour, of different degrees of intensity. This colour, also, exists less distinctly in a longitudinal band, along the lowest part of the abdomen. The tail is almost half the length of the body, is somewhat bushy, and terminated with bristly hairs.

There are several other species understood to be natives of the East, of which specimens and drawings have been brought to Europe; and in some of them the animals themselves have been obtained in the live state. Modern naturalists are inclined to refer both the Oriental and South American ones to a different genera from the glutton of the Arctic regions; but as they appear not to have made up their minds exactly with regard to the genera to which the different species should be referred, or how many of them should be made what is technically called the types of new genera, those matters of arrangement cannot be ren-

dered very interesting to the general reader. That there are many carnivorous animals in the tropical forests belonging to the plantigrade division of which we have no good account, and of many of which we have yet no account at all, there seems little reason to doubt; and from the extent of those forests and their tangled nature, interlaced as they are with climbing plants, and crowded with prickly ones, the exploring of even a portion of them is attended with much difficulty, and no little danger. But the vast quantity of food for such animals which those forests afford, and the general law of nature that there is always some proportion between the quantity of prey and the numbers of the preys, necessarily leads to the conclusion which we have stated. It is probable that these animals do not exactly take up the character of our badgers and continue it to the character of our martens, as the title of glutton is supposed to do in the north; because we must no more suppose that the succession of beings in a tropical climate must follow the gradation which it does in ours, than we must consider the tropical animal as having an individual type in our climates. From all that we know in the meantime, it is not improbable but that the animals in question may form a sort of gradation from the *Ailurus* (see that article), which has the claws partially retractile, to the *Paradoxurus*, of which some account will be found in its place in the alphabet. Indeed, there is a disposition to refer those Oriental animals which have hitherto been regarded as gluttons to the genus last mentioned; but much more information is required before this portion of the animal kingdom can be so well known as that we shall be warranted in speaking positively concerning it. One of the animals, once referred to the genus *Gulo*, and now to *Paradoxurus*, is,

THE MASKED GLUTTON (*G. larvatus*). This one is from the east, but what particular locality is not exactly known, although it is somewhere either in India or the eastern islands. It is larger and stronger than the European polecat; olive brown and grey in the general colour, but with the tip of the tail and the extremities of the feet black. The general colour of the head is black, but there is a large white streak from the forehead to the nose, some mottlings on the cheeks, and a paler band round the throat from the one ear to the other. The head of this one resembles not a little the dasyurus of Australia, and the body and tail have some resemblance to those of a cat. The essential characters are, however, different from either of these animals.

THE RATEL (*G. mellivora*) is found in Southern Africa, but it is also a native of India. It is about two feet in length from the nose to the tail, and the tail is about eight inches long. The body is marked by a broad ash-coloured stripe, which extends from the forehead the whole way to the tail, and at each side of this there is a grey stripe which separates the ash-colour from the black on the under part of the body. According to the accounts, this animal does not live so much upon other animals as upon honey, which it obtains by attacking the nests of the wild bees, and in this, it is said, they make use of another animal, which acts as a guide. Towards sunset it is particularly attentive in watching the motions of these industrious insects, following with great care the direction in which they fly. In its predatory range it is not unfrequently assisted by the *Cuculus indicator*, a bird which excites its attention by a loud grating cry, flying at the same time slowly forward to the

place where a swarm of bees have taken up their abode. The ratel follows the sound with great attention, and, having plundered the nest, leaves enough behind as a reward for the services of its guide. Owing to the toughness of its skin, it has little to dread from the stings of the insulted bees. The nests, however, which are built on trees, are beyond its reach. In the first transports of its rage it gnaws and bites the trunk, and these bites are sure marks for the inhabitants that a bees' nest is to be found there. Such is the account given of this animal in Southern Africa; and we shall add that given of it by General Hardwicke as a native of India. "The claws," says the General, "are unequal, those of the fore feet very long and awl-shaped, the three middle ones much longer than the two lateral; the interior toe very remote from the rest; the claws of the hind toes remarkably short, nearly equal, and bearing no comparison to the strength of the fore feet."

"This animal is found in several parts of India along the courses of the Ganges and the Jumna, in the high banks, which in many parts border these rivers. It is rarely seen by day, but at night visits the neighbouring towns and villages inhabited by Mohammedans, and scratches up the recently buried bodies of the dead, unless they are quickly covered with thorny bushes."

"The natives, when encouraged by the expectation of purchasers, dig the animals out of their subterraneous retreats, and take them alive. The full-grown ones are with difficulty secured, and seldom bear confinement long, but roll and beat themselves about till they die. When taken young, they are very manageable, docile, and playful. It is a bold animal, its hide remarkably thick, and its strength too much for most dogs of common size. Its general food is flesh in any state, but it is remarkably eager after birds, and living rats seem almost equally acceptable. It has an inclination to climb upon walls, hedges, and trees. This, however, it seems to execute clumsily, but seldom falls, and will ramble securely upon every arm of a branching tree that proves strong enough to bear its weight without much motion. This species burrows with great facility, scratching the earth like a dog with the fore feet, and expelling the loosened soil to the distance of two or three yards backward. In ten minutes it will work itself under cover, even in the hardest ground, and is restless till it can form such a retreat to sleep in. It sleeps much by day, is watchful during the night, discovering inquietude by a hoarse call or bark proceeding from the throat. The hair is short and wiry, nor has it any of the softness of fur. It is known to the natives of Hindostan by the name *Bæjoo*."

Other species of smaller dimensions, and found in various tropical climates, have been mentioned by different authors. The illustrious Humboldt, for instance, mentions one which he observed in the Andes, and to which he gave the name of *Gulo Quitensis*. It is of small size, black in the colour, with a white band along each side, and the tail marked with white and black. There are also several other species, among which we may mention one of very peculiar shape, and of a chestnut colour, which was preserved in the late Bullock's Museum. This one measured about two feet three inches in the length of the head and body, and a foot and a half in the tail, which was very bushy. The body was long and lanky, but the legs were very stout, and the

claws large and very much crooked. Altogether, its appearance was peculiar, though abundantly expressive of ferocity, but where it came from was unknown; and we have not heard that any living specimen has been seen. There have also been found, in some of those ancient charnel-houses of Europe which contain the bones, or partly the bones, of animals not now found in that quarter of the world, along with those of others which are extinct everywhere, certain bones which have been referred to the gluttons, and from which one might conclude that, at some period of European history, they were much more plentiful in species and in individuals than they are now; and there seems to be some sort of evidence of this in the fact of their remnant being driven, as it were, to the verge of the extreme north.

On a portion of zoology that offers so many difficulties, and respecting which the accounts are so imperfect, and so much at variance with each other, it might not be wise to hazard any very positive conclusion. But, from all the evidence, it should seem that there are three distinct families of those animals, each taking a type from a particular locality, and differing entirely from the others. First, there is the northern one, consisting of only the common glutton, and its coloured varieties, at least we know of none else. Secondly, there are the South American species, which seem to partake of the general character of the mammalia of that quarter of the world, in being different from all the rest. It is possible that the typical animals to which these are allied are the genus *Mephitis* of Cuvier, which are so remarkable for the offensiveness of the smell which they give out when disturbed. Thirdly, the eastern animals, which have for their best known type the *Civets*, which are also furnished with a scented secretion, but which, to some at least, is considered agreeable. More information is wanted, however, before we can accurately arrange these extraordinary animals.

GUM ARABIC TREE is the *Acacia Arabica* of Willdenow. A native of the East Indies.

GUM CISTUS is the *Cistus ladaniferus* of Linnæus. A flowering shrub, long one of the ornaments of our gardens. It belongs to the natural order *Cistineæ*.

GUM SUCCORY is the *Chondrilla juncea* of Linnæus. A herbaceous perennial, native of Europe, belonging to *Compositæ*.

GUM TREE is the *Eucalyptus robusta* of Smith. A timber tree indigenous in New Holland, and belonging to the natural order *Myrtaceæ*.

GUSTAVIA (Linnæus). A genus of plants named in honour of Gustavus III., king of Sweden, the patron of his learned subject Linnæus. Class and order *Diadelphia Polyandria*, and natural order *Myrtaceæ*. Generic character: calyx superior, turbinate, whole, or very obtusely toothed; petals four, six, or eight, large and ovate; stamens shorter than the petals, united at the base; anthers oblong and erect; style filiform; stigma simple; seed vessel leathery, roundish, from three to six-celled, and without valves. There is only one species described. It succeeds in our stoves, and is propagated by cuttings rooted in strong heat.

GUTTIFERÆ. A natural order containing about a dozen genera, many of which are highly interesting plants. They are trees or shrubs found in the hottest parts of the world; the leaves are opposite, leathery, entire, with short petioles, a strong midrib and often

with parallel costulæ extending to the margin, and without stipules.

The inflorescence is in general axillary and racemose, but sometimes terminal and paniculate, or crowded and lateral. The calyx is from two to six sepaled, often persistent, roundish, membranaceous, frequently irregular and coloured; petals from four to six, rarely more; stamens numerous, indefinite, and inserted below the germen; the germen is superior and free; style none or very short, and the stigma peltate and radiate with the style cleft. The fruit is dry or succulent, either baccate, capsular, or drupaceous, and one or many celled, one or many seeded. Among them is the mangosteen, considered one of the most delicious of fruits. The flowers of all the order being showy, the foliage good, and the properties interesting, every species deserves cultivation.

GYMNADENIA (Richard). A genus of hardy herbaceous plants, belonging to the natural order *Orchideæ*. They were formerly included in the genera of *orchis* and *satyrium*, by Linnæus, but separated by Richard and Sprengel. When cultivated they are kept in shady borders of bog-earth.

GYMNARCHUS. A genus of soft-finned fishes without ventral fins, belonging to the eel-shaped family, but having little resemblance to the common eels. The generic characters are, the body elongated and scaly, the gills with but little opening, as in the genus *Gymnotus*; but there is all along the back a soft rayed fin, contrary to the gymnoti, and, unlike them also, there is no fin between the vent and the tail, and the tail terminates in a point. The head is conical and without scales, the mouth small, and furnished with a single row of trenchant teeth in each jaw. There is but one known species, *G. Niloticus*, which is, as its name imports, a native of the Nile, but nothing is known of its habits.

GYMNEMA (R. Brown). Climbing ornamental plants from the East Indies, formerly called *Asclepias*, *Asclepiadæ*.

GYMNOCLADUS (Lambert). An ornamental shrub or tree, a native of Canada. It belongs to *Leguminosæ*, and is increased by cuttings of its roots.

GYMNOPLEURUS, (Illiger). A genus of coleopterous insects, belonging to the section *Pentamera*, sub-section *Lamellicornes*, and family *Scarabæidæ*; distinguished by having the body depressed, the elytra deeply notched, or sinuated, near the shoulders, the middle legs widely apart, the four posterior tibia ciliated with small spines, and the last joint of the tarsi as long as all the remainder together; the thorax has an impression on each side. The type of this genus, of which there are numerous species, is the *Atcuchus pilularius* of Fabricius, which has obtained its specific name from the curious manner in which the eggs are deposited, and which is thus described by Catesby, as observed in a North American species, known by the name of the tumble-dung beetle; like our dung beetles, *Geotrupes*, these insects bury their eggs in dung, but the latter form the mass in which they are enclosed into small balls. "I have attentively admired their industry," he proceeds, "and mutual assisting of each other in rolling their globular balls from the place where they made them to that of their interment, which is usually the distance of some yards, more or less. This they perform breech foremost, by raising their hind parts and forcing along the ball with their hind feet. Two or three of them are sometimes engaged in trundling

one ball, which, from meeting with impediments on account of the unevenness of the ground, is sometimes deserted by them. It is, however, attempted by others with success, unless it happens to roll into some deep hollow or chink, where they are constrained to leave it; but they continue their work by rolling off the next ball in their way. None of them seem to know their own balls, but an equal care for the whole appears to affect all the community. They form these pellets while the dung remains moist, and leave them to harden in the sun before they attempt to roll them. In their moving of them from place to place, both they and the balls may frequently be seen tumbling about over the little eminences that are in their way. They are not, however, easily discouraged; and by repeating their attempts, usually surmount the difficulties. They find out their subsistence by the excellence of their organs of scent, which direct them in their flight to newly fallen dung, on which they immediately go to work, tempering it with a proper mixture of earth. So intent are they always on their employment, that though handled, or otherwise interrupted, they are not to be deterred, but immediately on being freed, persist in their work without any apprehension of danger. They are said to be so extremely strong and active, as to move about, with the greatest ease, things that are many times their own weight. Dr. Burchell was supping one evening in a planter's house of North Carolina, when two of them were conveyed, without his knowledge, under the candlestick. A few blows were struck on the table, and, to his great surprise, the candlestick began to move about apparently without any agency; and his surprise was not much lessened when, on taking one of them up, he discovered that it was only a chafer which moved."

It has been the good fortune of the writer hereof to examine a living specimen of the North American species, whose habits are recorded in the above extract, and which was brought to this country from the United States, having lived during the passage without taking any food.

GYMNOTUS (electric eel). *Gymnotus*, literally means "naked back," and, as applied to a fish, it imports that there is no dorsal fin. The electric eel, so celebrated in natural history, is not the only species, even when the genus is cleared of some which do not belong to it; it is, however, the one which is most interesting, and therefore our attention shall be chiefly directed to it.

The characters of the genus are: the gills partly closed by a membrane, but this membrane opens in front of the pectoral fins; the vent placed far forward, so that the anal fin extends the greater part of the length of the body, and generally to the very extremity of the tail. There is no dorsal fin, and even in the gymnotus, properly so called, there is no caudal fin, though the anal fin extends under the tail to its extremity. The skin is without any perceptible scales; the intestines are much folded, and have numerous cæca. They have a double air-bladder, one branch of which extends far back into the cavity of the abdomen; the other is oval, consisting of two lobes, and lies immediately over the gullet. All the species which are known are inhabitants of the rivers and fresh water pools of South America. That which has attracted the greatest attention is

THE ELECTRIC EEL (*Gymnotus electricus*). From the singular power with which it is furnished of giving

electric shocks, often very severe, as well as from the very peculiar apparatus upon which this power appears to depend, the electric eel is not only one of the most extraordinary of fishes, but it is one of the most wonderful productions of living nature; and if it were possible to carry our physiological analysis so far as to ascertain what connexion there is between the action of life in the animal and the charging and discharging of its electric, or rather galvanic battery, it would bring us one step nearer to that mysterious relation which there unquestionably is between electric action and animal life.

This singular fish is of considerable size, being very frequently between two and three feet in length, and instances are mentioned of specimens five feet, or even six feet, in length, being found. It is a thick and heavy looking fish too, not possessed of the "lithe" form of the common eels; the body is pretty uniform in thickness throughout, though it is rather more compressed than the body of an eel; and when the length is about four feet, the circumference at the thickest point is more than fifteen inches, and the depth in the side about seven. The head is full of little vesicles, which secrete a sort of slimy matter, wherewith the body of the fish is lubricated; and similar organs, though smaller in size, are scattered over different parts of the body and tail. When we say the tail of this fish, we of course mean all that part of it which is behind the vent; for as there is no caudal fin, there is no specific tail other than this portion of the body. So copious is the discharge of this matter, that when the fish is kept alive as a curiosity, which it often is, in troughs or large tubs of water, in its native country, the water requires to be frequently changed. From the feeding of those specimens, it is ascertained that the food of this curious fish consists indiscriminately of worms and small fishes; for it eats either of these with equal avidity.

It is far from a handsome fish; and its colour is dull, being an obscure blackish green, with a few dark stripes, barely perceptible. Its tail, even in point of muscular vigour, is a most powerful instrument, and amply compensates for the deficiency of fins. In the northern parts of the South American continent it is very common, being found equally in the great rivers, the small streams, and the stagnant pools; and in those places where the water forms the only pathway, as it not unfrequently does in the wilds of those countries, this fish is a most formidable creature. The vigour of the animal, its serpent-like form, its dark appearance, and the violence with which it gives its shocks, all tend to make it an object of terror; and those who are fond of fanciful writing have endeavoured to persuade their readers that the same energy of the sun which, in those lands of extreme heat and fertility, matures the choicest fruits, and calls forth the beauty and the perfume of the finest flowers, also gives deadly strength to the boa, the most fatal poison to the bush-master, and this strange electric action to the gymnotus.

The apparatus in which evidently this power is lodged, is a very singular one, and consists of four organs, which are situated longitudinally in the tail of the fish (which, as we have said, constitutes by far the greater part of it), and those organs amount to between a half and a third of the whole volume of the tail,—indeed they occupy a full third of the whole volume of the fish. The larger organ occupies the middle of the side, and extends to the extremity of

the tail; and the two are separated from each other by the muscles of the back. The small ones are under these, and extend nearly the same length, but are altogether much smaller, and very slender toward the tail. The two smaller organs are separated from each other along the mesial line by the bones of the anal fin, and the muscles which give motion to that fin; and there are also small muscles between those small organs and the skin. The larger ones are separated from the skin, or rather united to it by loose cellular tissue only, so that upon the skin being removed they are seen at once. The organic part of this singular apparatus consists of a vast assemblage of cells, which fancy can easily conceive to have some analogy to the phials in an electric battery, or rather perhaps to the divisions of a galvanic one, for the cells are, like those divisions, filled with a liquid. The partitions of the cells consist of flat longitudinal septa, crossed by nearly similar partitions. The septa extend nearly the whole length of the fish, and have their breadth not much less than half the diameter of the body. They consist of thin and delicate membranes. These septa are, in the large organs, nearly straight and parallel to each other for the greater part of their length, and in consequence of this they are not all the same length. Neither are they at the same distance apart throughout the whole of their breadth. They are widest externally, and converge toward the interior. Whether the number is the same in large and small specimens has not been clearly ascertained; but such may be the case. In a fish two feet four inches long there were thirty-four at the broadest part, and they were nearly half an inch apart externally. In the smaller organs the septa are curved or serpentine, and much nearer each other; so that though only half an inch in breadth in the specimen alluded to, this organ contained forty. The space between every two septa appears to be a distinct organ; and these organs are divided crosswise by remarkably thin partitions, which are near to each other; so that Dr. Hunter counted two hundred and forty in an inch in length. The minute cells formed by those transverse partitions are filled with a fluid; but what the particular nature of this fluid is in the living animal, or how it acts upon the partitions, so as to produce the electric energy, has not been, and possibly cannot be ascertained. Still there is a wonderful resemblance between those organs and galvanic troughs; but the incomprehensible part of the matter is, how the animal contrives to make those troughs act. If the animal is touched with one hand only, that is, if it is touched only in one place, no shock is felt; but if it is touched at two places considerably apart from each other, the shock is very violent. Humboldt states that he felt more pain from the shock of a large gymnotus than from that of a powerful electric spark; and when he placed both feet upon one newly out of the water, at some distance from each other, he received a most violent shock, and felt pain for the rest of the day, not only in his legs, but in almost every joint of his body.

It appears, from the experiments of Dr. Williamson, Mr. Walsh, and many others, that nearly the same substances are conductors and non-conductors of the shock of the gymnotus, as are conductors and non-conductors of common electricity. It may with perfect impunity be touched with a glass rod, or with the hand wrapped up in a dry silk handkerchief; but metals, water, and all moist bodies, conduct it

readily. The shock is conveyed to a considerable distance from the animal, so that it can strike the smaller fishes dead, or, at all events, deprive them of motion at the distance of fifteen feet. One of the experiments made by Dr. Williamson is worthy of mentioning. He took a common cat-fish, which is a very vigorous fish, put it into the water, and placed his hand in the water, watching what would occur. The gymnotus swam up to the cat-fish, but, in the first instance, turned away without doing anything. It speedily came back, however, and discharged its battery at the cat. While it did so, the Doctor felt a severe shock in his fingers, and the cat turned on its belly, and remained motionless. With several other fishes the result was similar; but, though stunned, it does not appear that they were killed, or even received any permanent injury, for, when instantly put into water apart from the gymnotus, they speedily recovered. Hence it is probable that the shocks given by this fish serve only to benumb its prey until it can swim up and devour them. Instances are mentioned of fishes of this formidable genus of much greater dimensions than those to which we have alluded; and the Indians say that swimmers are often drowned by the stroke of a large gymnotus, and that the most powerful quadrupeds share the same fate.

That the shocks are voluntary on the part of the animal, that is, given or not given, according as it is disposed, is a proof that, though the electric battery is a mechanical or organic structure, the working of it is a function of life. This is farther proved by the fact, that, when these fishes have been provoked, and made to discharge their batteries repeatedly, until they are exhausted, they may be taken in the hands with little more danger than any other fish, for it appears that the electric organs take some time to recover their tone. "In America," says Humboldt, "they take advantage of this interval, and catch these fishes with but little risk. They force wild horses to enter the ponds inhabited by the electric eels. These unfortunate quadrupeds receive the first discharges; stunned and overthrown, they disappear under the water, and the fishermen take possession of their assailants either with their nets or with the harpoon. The combat is finished in about a quarter of an hour."

The water in which Humboldt saw experiments made on those eels was of a much higher temperature than the water of Europe in the open air; and Humboldt rationally concludes that the inferior temperature is the cause of the weakened power in those individuals which have been tried in Europe. The gymnotus is not the only electric fish. That power in the torpedo has been known from remote antiquity; and it is also possessed by a species of *Silurus*, by one of *Trichiurus*, and by one of *Tetraodon*. In all (notices of which will be found in their respective places), the organs appear to be substantially the same, but there appears to be none which in the power of its shocks comes nearly up to the gymnotus. The following account, by Humboldt, of the method of taking the gymnotus, is so characteristic and so well told, that we shall make no apology for laying it before our readers:—"Having," says Humboldt, "remained for three days to no purpose in the town of Calabozo, and received but a single eel, and that rather weak, we resolved to proceed to the banks of those pools in which gymnoti abound, and make our

experiments in the open air. We came first to a small village named *Rastro de Abaro*. The Indians conducted us thence to the Cano de Beru, a reservoir of miry and stagnant water, but surrounded by rich vegetation. We were greatly surprised when they informed us that they were going to catch about thirty half-wild horses in the neighbouring savannahs, to employ them in fishing for the electric eels. The idea of this sort of fishing, which they call *embarbasear coucaballas* (deadening by horses), is singular enough. The word *barbasee* signifies the root of any poisonous plant, by the contact of which a great mass of the water receives, in an instant, the power of killing, or, at least, of intoxicating and benumbing the fish. These come to the surface of the water when they have been poisoned by this means. As the horses, driven here and there through a pond or pool, produce the same effect upon the alarmed fishes, the Indians, confounding cause and effect, apply the same appellation to the two kinds of fishing. While our host was explaining to us this strange system of fishing, a troop of horses and mules arrived. The Indians had made a sort of enclosure around them, and, pressing them closely on all sides, forced them to enter the water. I shall but imperfectly depict the interesting spectacle presented to our view by the combat of the eels against the horses. The Indians, provided with very long reeds and harpoons, placed themselves around the basin. Some of them mounted upon trees, whose branches overhung the surface of the water. They all prevented, by their cries and the length of their reeds, the horses from attaining the shore. The eels, stunned and confused by the noise of the horses, defended themselves by the reiterated discharge of their electric batteries. For a long time they seemed likely to gain the victory over the horses and mules. These were seen in every direction, stunned by the frequency and force of the electric shocks, to disappear under the water. Some horses, however, rose again, and, in spite of the active vigilance of the Indians, gained the shore exhausted with fatigue, and, their limbs being benumbed by the electric commotions, they stretched themselves at full length upon the ground. I could have wished that a skilful painter had had the opportunity of seizing the moment when the scene was most animated. The groups of Indians surrounding the basin—the horses with their manes bristling, terror and anguish depicted in their eyes, trying to escape the storm which surprises them—the yellowish and livid eels, which, like huge aquatic serpents, are swimming on the surface of the water, and pursuing their enemy—all these objects presented, without doubt, the most picturesque assemblage imaginable. I remember the superb picture of a horse entering a cavern and frightened at the view of a lion. The expression of terror is not stronger there than what we witnessed in this unequal contest. In less than five minutes two horses were already drowned. The eel, more than five feet long, glides under the belly of the horse or mule; it then makes a discharge from the entire extent of its electric organ. It attacks at once the heart, the viscera, and particularly the *plexus* of the gastric nerves. It is not, therefore, surprising that the effect it produces on a large quadruped should exceed that produced upon a man whom it touches only at one of his extremities. I have my doubts, however, whether the gymnotus kills the horses immediately. I rather believe that the latter, stunned by the reitera-

tion of the electric shocks, fall into a profound lethargy. Deprived of all sensibility, they disappear under the water; the other horses and mules pass over their bodies, and they perish in a few minutes. After this commencement, I was afraid that the sport might terminate very tragically. I did not doubt that, by degrees, the greater part of the mules would be drowned. Eight francs is paid for each of them, if the master happens to be known. But the Indians assured us that the fishing would be soon at an end, and that nothing is to be dreaded but the first attack of the gymnoti. In fact, whether the galvanic energies are accumulated in repose, or the organ ceases to perform its functions, when fatigued from too long use, the eels, after a certain time, resembled discharged batteries. Their muscular motion is still equally active, but they have no longer the power of giving electric shocks. When the combat had lasted a quarter of an hour, the mules and horses were less affrighted; they no longer bristled up the mane, and the eye was less expressive of fear and suffering. They were no longer seen to fall backwards; and the eels, swimming with the body half out of the water, and now escaping from the horses instead of attacking them, began themselves, in their turn, to approach the shore." The Indians, and also the negroes, eat the flesh of those singular fishes, but it is said to be hard, flavourless, and not very nutritious. After this celebrated species, the other gymnoti can hardly bear to be mentioned.

GYNANDROPSIS (De Candolle). A genus of tropical herbs, belonging to the natural order *Capparidæ*, separated from *Cleome* by De Candolle.

GYPSOPHILA (Linnæus). A genus of annual and perennial herbs, natives of Europe. They bear decandrious flowers, and belong to the natural order *Caryophyllæ*. The smaller species do well on rock-work, and the larger have a place on flower borders. They are propagated by cuttings or seeds.

GYRINIDÆ. A family of coleopterous insects belonging to the section *Pentamera* and sub-section *Hydradephaga*, or water-beetles, and distinguished by the minute size of the antennæ, which are clubbed, and shorter than the head, the second joint being dilated externally into a kind of ear; the two fore legs are long, and advanced in front like arms, but the four posterior legs are very short and compressed, but broad, forming two pair of short strong oars. The eyes are four in number, two being placed above and two below; the palpi are very small; the thorax short and transverse; and the elytra oval, depressed, and obtuse at the extremity, leaving the tip of the abdomen exposed.

This family corresponds with the genus *Gyrinus* of Linnæus, and, unlike the *Dyticidæ*, to which they are nearly allied, these insects are distinguished by the metallic brilliancy of their covering; living for the most part upon the surface of the water, they receive the impressions of the light in a more direct manner than the *Dyticidæ*, and are accordingly ornamented with tints of a brassy or bronzed metallic hue, which glitter in the sun in the highest degree. The velocity with which they execute their evolutions upon the surface of the water is really surprising, and has obtained for them the name of tourniquets by the French, and whirlwigs and water-flies by the English. Sometimes, indeed, they remain stationary for a time, so that it seems easy to secure them, but on the least motion they are instantly alert, escaping

with surprising agility and diving to the bottom of the water. The situation of their eyes adds greatly to their defence, enabling them to see objects both above and below them. One of our most popular writers on natural history thus describes their proceedings:—"Water, quiet still water, affords a place of action to a very amusing little fellow (*Gyrinus natator*), which, about the month of April, if the weather be tolerably mild, we see gamboling upon the surface of the sheltered pool; and every school-boy who has angled for minnows in the brook, is well acquainted with this merry swimmer in his shining black jacket. Retiring in the autumn, and reposing all the winter in the mud at the bottom of the pond, it awakens in the spring, rises to the surface, and commences its summer sports. They associate in small parties of ten or a dozen, near the bank, where some little projection forms a bay, or renders the water perfectly tranquil; and here they will circle round each other without contention, each in his sphere, and with no apparent object, from morning until night, with great sprightliness and animation; and so lightly do they move on the fluid, as to form only some faint and transient circles on its surface. Very fond of society, we seldom see them alone, or, if parted by accident, they soon rejoin their busy companions. One pool commonly affords space for the amusement of several parties, yet they do not unite or contend, but perform their cheerful circlings in separate family associations. If we interfere with their merriment they seem greatly alarmed, disperse or dive to the bottom, where their fears shortly subside, as we soon again see our little merry friends gamboling as before."—*Journal of a Naturalist*, vol. i. p. 307. When they dive to the bottom of the water in the manner above described, they carry with them a little bubble of air affixed to the extremity of the body. Also they are sometimes to be found flying, their well-formed wings permitting such an operation, whilst the high polish of the body protects them from the action of the water.

With the exception of a few exotic species, the insects of this family are of a small size, seldom exceeding a quarter of an inch in length, and the largest ones do not reach one inch. Some of the species are found on the margins of the ocean. They emit, when touched, a disagreeable scent, arising from a milky fluid which exudes from the different parts of the body, and which is not readily dispelled.

The structure of the fore legs indicates their mode of life, serving as arms to convey the food which they find floating upon the surface of the water, and which consists of small dead insects, &c., to the mouth.

The number of species of this family does not exceed fifty or sixty, and of these not more than eight or nine are found in this country; of these the *Gyrinus natator* is the most common species. It is of a brilliant bronzy-black colour, with the sides of the body and antennæ metallic; the margins of the elytra and legs are reddish. The elytra are ornamented with lines of impressed spots. It is about a quarter of an inch in length.

HABENARIA (R. Brown). A genus of tuberous rooted herbs, indigenous to the northern parts of the world, some of which were formerly called orehis; they all belong to the natural order *Orchideæ*. They are cultivated in shady borders or in frames.

HABRANTHUS (Herbert). A genus of hardy

and greenhouse bulbs, some of them remarkable for the fine scent of the flower. They belong to *Amaryllideæ*. They are treated like other bulbs.

HÆMANTHUS (Linnæus). A highly ornamental genus of African bulbs, called blood-flower, from the deep colour of their blossoms. They belong to the sixth class of Linnæus, and to the natural order *Amaryllideæ*. Generic character: spatha of four or six valves, involving many flowers, and persisting; flowers in a dense bunch; corolla tubular at the base; limb six-cleft, regular and erect; stamens imposed on the tube of the corolla protruding; filaments awl-shaped; anthers incumbent; style simple; berry three-celled: these bulbs thrive best in sandy loam and moor-earth, requiring no water but when in a growing state, and are increased by offsets.

HÆMATOPOTA (Meigen). A genus of dipterous insects, belonging to the family *Tabanidæ*, and distinguished from the gad-flies (*Tabanus proper*) by wanting the ocelli, and by the antennæ, of which the terminal portion consists but of four joints, sometimes cylindric and subulated, the first being thick, and nearly oval, in the males. These insects, which abound in the neighbourhood of woods, are exceedingly tormenting to persons walking in such situations, settling upon the exposed parts of the body with a touch so slight that their presence is not perceived until they have contrived to insert their powerful proboscis into the flesh, causing a very acute pain. They are of smaller size than the *Tabani*, and their wings are elegantly ornamented with dark spots and rings upon a pale ground. There are several British species, the type of the genus being the *Tabanus pluvialis* of Linnæus. The name of the genus is derived from two Greek words, signifying sucker of blood.

HÆMATOXYLON (Linnæus). The *H. Campechianum* is the logwood of commerce, and belongs to the natural order *Leguminosæ*. Logwood is astringent, and both in decoction and extract has a sweetish taste, which makes it preferable to many other vegetable astringents as a medicine. The chief use of logwood is, however, as a dye-stuff; and for this purpose large quantities are imported into this country every year, from the British West Indies, Mexico, and the United States.

HÆMODORACEÆ. The name of a natural order containing ten genera, and above twenty-four species, chiefly cultivated in greenhouses. The name of this order, says Dr. Lindley, is derived from its blood colour, indicating its most striking peculiarity: the roots of several species of *Hæmodorum*, *Wachen-dorfia*, and *Heritiera*, yielding a brilliant crimson dye. The species have equidistant leaves, and six stamens, with anthers turned towards the ovarium; in which last character they differ from the closely allied order of *Irideæ*. They are found, with few exceptions, at the Cape of Good Hope and New Holland.

HAIR GRASS. Is the *Aira flexuosa* of Linnæus, one of the British grasses.

HAKEA (R. Brown). A pretty extensive genus of Australian plants, belonging to the fourth class of sexual botany, and to the natural order *Proteaceæ*. The flowers are sweet-scented, and are desirable greenhouse plants, thriving in sandy loam and moor-earth, and propagated by cuttings.

HALESIA (Linnæus). A genus of North American shrubs or small trees, vulgarly called from the shape, colour, and position of the flowers, snowdrop

tree. They belong to *Dodecandria*, and the natural order *Styracineæ*. They are interesting shrubby plants, and are increased by layers or by cuttings of the root.

HALICTUS (Latreille). A genus of hymenopterous insects, belonging to the section *Aculeata*, sub-section *Mellifera*, or bees, and family *Andrenidæ*, or short-tongued bees. The characters of this genus will be found under the article *ANDRENIDÆ*; but as no account is there given of the economy of the species of the genus, we will take this opportunity of supplying the deficiency, chiefly from a valuable memoir, published in 1817, upon two of the species, by the Baron Walckenaer, a celebrated French naturalist. There is an extensive colony of one of the species established at the foot of the wall of the barracks in the turnpike-road near the entrance to Kensington palace, where we have often noticed the insects. Nevertheless the species are solitary in their habits, the individuals having no tie upon each other, and the congregation resulting merely from a convenient locality. It is a curious circumstance, that it is only during the night that the bees construct their nests, which consist of a perpendicular passage, extending to a considerable depth, and then branching off into several other shorter passages, at the bottom of each of which a mass of pollen paste is deposited with an egg, the ball of the former being about the size of a pea, and serving for the support of the larva when hatched. During the day either the male or female bee remains at the mouth of the burrow, in order to prevent the entrance of enemies, such as cuckoo-flies (*Tachinæ*), and ichneumons, or ruby-tailed flies (*Chrysididæ*). On the return of its partner, which takes two or three circular flights round the mouth of the burrow, the sentinel immediately withdraws into the nest to make way: moreover it is worthy of notice that, instead of alighting upon any adjacent object, as is generally the case with burrowing insects, the halicti fly at once into the nests; a circumstance attributed by Walckenaer to the desire to elude their enemies, of which there is a fearful catalogue, the most ferocious being the *Cerceris ornata*, of whose habits we have given an account under that genus. The preceding observations relate to the *Halictus terebrator* of Walckenaer, or the *Melitta fulvo-cincta* of Kirby, one of the smallest species of the genus; but in the other species observed by Walckenaer, *Halictus eca-phosus*, or the *H. 6-cinctus* of Latreille, which is one of the largest of the species, the habits are different in some respects,—large, strong, and fearing but little for the enemies which prey upon their smaller brethren, this species works by day, and during the greatest heat. The entrance to the burrows is large enough to admit two individuals at once, whereas in the other species it is only of the size of the head of the insect. The direction of the burrow is also different, and, instead of diverging into several channels, it terminates in a large round cell, two inches and a half in diameter and three inches high, filled with earthen cocoons, attached loosely together, leaving various channels between them. When examined, it is found to consist of about a score of earthen cocoons, each having the mouth closed, so that the enclosed inhabitant has no communication with the external air. The inner walls of the cocoons are finely polished.

HALIMODENDRON (Fischer). This genus of plants was formerly called *Robinia* by Linnæus and

Heritier, and *Caragana* by Lambert: but finally described and renamed by Fischer. It belongs to *Leguminosæ*, and forms a pretty shrub in flower borders: may be increased by seed or by grafting on the *Caragana arborescens*. The plants are natives of Siberia, and are there called salt or sea trees.

HALIOTIS (Linnæus, and modern authors). This well-known but elegant mollusc constitutes a well-defined genus, numerous in species, and remarkable for their *ear-like* form, whence the derivation of their name, sea-ear. As this shell is to be met with in every collection, a minute description of it, in scientific language, would here be useless; we will, nevertheless, give its general characters. The substance of the shell is internally brilliantly nacreous; it is extremely depressed, more or less of an oval shape, with a very small spiral termination, and very flat. The aperture is the full size of the shell; its edges continuous, the right one thin and trenchant, the left flattened, enlarged and sharp, parallel to the left side; a series of holes exist, which serve for the passage of the two-pointed lobes of the animal's mantle. There is only one great muscular impression. The animal is entirely covered by its shell. As the increase of the animal's size requires an extension of its protecting covering, a new hole is commenced, appearing at first only a notch on the margin, afterwards completed as the growth of the shell continues, and others are formed in succession, while the perforation nearest the spire is carefully closed in the same succession, leaving, however, in almost every instance, six holes at the same time open. When the animal is at rest it adheres, like the patella, to the rock or substance on which it is found, and can only be detached by a sudden effort, as they have resisted the application of a lever, till every portion of their shell was so far broken as no longer to furnish a point of resistance. An ingenious naturalist has calculated that it would require at least a ton weight to force these shells from their resting place, could the substance of them withstand the application of the necessary mechanism, such is the perfect vacuum formed by the animal. There are probably few of our readers who, in the early part of life's dream, have not witnessed this philosophical fact by the simple application of a piece of wet leather to any heavy substance; as the subject, however, is most ably explained in the First Division of this work, we need not here go into it, but proceed with a description of the animal constructing the haliotis. Its body is of a very depressed oval shape, slightly spiral backward; it is provided with a large foot, doubly fringed round its circumference; the head flattened, tentacula conical at the base, and a little flattened; the eyes are placed at the summit of prismatic peduncles, situated on the external edge of the tentacula; the mantle is very thin, deeply divided on the left side; the two-pointed lobes form, by their junction, a canal to conduct water into the bronchial cavity, situated on the left side, and inclosing two very long, unequal, bronchial combs. These molluscs adhere to rocks nearly on a level with the sea, and, during the fine summer nights, wander to feed on the herbaceous plants that grow near the shore. Their flesh is considered good eating, and in Guernsey they are sold in the market in common with other shell-fish. Lamarck sub-divided this genus, separating from it those species which were imperforate (or without holes); his *Stomatia* is an

instance ; this Linnæus named, with great propriety, *Haliotis imperforata*. Leach also formed a genus, which he named *Padollus* ; but these have all been united by the modern French naturalists, who make them merely sub-divisions of the *Haliotis*. These molluscs inhabit the seas of all parts of the world, and vary greatly in size, the writer of this article having possessed them from the 10th of an inch to 18 inches in length. A number of the latter magnitude, some years since, were brought to this country, it was said from California ; but of late years no such large examples have been imported from any country whatever. It is believed that no fossil examples of *Haliotis* have ever been discovered. The genus is ranked in the second class, *Paracephalophora*, third order, *Scutibranchiata*, first family, *Otidea*, in which the organs of respiration are constantly situated on the animal's left side. This genus might, doubtless, become more clearly defined by an elaborate classification of its species in their natural proximities ; but it would be impossible to point out any thing more characteristically marked than these molluscs are from every other known.

HALIPLUS (Latreille). A genus of coleopterous insects, belonging to the section *Pentamera*, and family *Dyticidæ*, and distinguished from the other genera of this family of water-beetles by having the base of the hind legs covered by a large shield-like plate composed of the dilated coxæ of these organs ; the palpi are also terminated by a minute conical joint, in which respect they resemble the minute species of *Bembidiidæ* (belonging to the adjoining family *Carabidæ*), which are also sub-aquatic in their habits, whence these insects have, by some systematists, been considered as forming the point of connection between the two groups. The species are very numerous, of very small size, and may be constantly observed swimming about with great agility in almost every running or standing water ; the type of this genus being the *Haliplus elevatus*, which is at once distinguished by the elevated lines upon the elytra.

HALLERIA (Linnæus). Ornamental greenhouse shrubs, from the Cape of Good Hope. The flowers are didynamous, and belong to the natural order *Scrophularineæ*. The plants grow freely in an equal mixture of loam and moor-earth, and are propagated by ripened cuttings in sand.

HALLIA (Thunberg). A papilionaceous genus of plants cultivated in the greenhouse, and succeeds with the ordinary treatment thereof.

HALORAGEÆ. A natural order, containing, according to the Hortus Britannicus, seven genera, and about twelve species, which, according to the same authority, are mostly obscure weeds, distinguished from *Onagrariceæ* by their naked and solitary ovula. They are natives of moist places or ponds, in various parts of Europe and North America. Some of the species of *Haloragis* are tropical. They are not known to possess any medicinal properties.

HALORAGIS (Forster). A genus of small New Zealand plants, belonging to *Octandria Tetragynia*, and to the natural order to which they give a title. They require greenhouse management.

HALTICA (Geoffroy). A very extensive genus of minute coleopterous insects, belonging to the section *Tetramera*, and family *Galerucidæ*, distinguished by the large size of the hind thighs, which enable the insects to leap about with great agility. They are

for the most part ornamented and varied with brilliant colours and shining bodies, and commit great havoc upon the leaves of vegetables, both in the larva and perfect states. The greatest number of species are, however, found in South America, but these are for the most part of a much larger size than those found in our own country. From the extent of the genus it has become necessary to subdivide it extensively. Illiger did this in the *Magazin der Entomologie*, proposing nine sections, which more recent authors, as Latreille and Stephens, have regarded as so many distinct genera.

It is to this genus that the small insect belongs, which is generally known under the name of the *Turnip-fly**, but which, as there are several hymenopterous flies which likewise feed upon the turnip, it would be more proper to distinguish as the *turnip-flea*, naming it thus in allusion to its leaping agility. The ravages of this minute insect upon this valuable plant are unfortunately too well known to agriculturists to need much description. The insect is indeed one of the most formidable that can attack a crop. What possibly can be more harassing to the farmer than to see a fine thriving field of turnips just appearing in leaf, destroyed in the course of a day or two by enemies which are so minute as almost to escape detection, and so obscure in their habits, as up to the latest moment to have escaped in this respect the observation even of practised observers of insects ? Whilst doubting too whether his crop may possibly recover, the unfortunate agriculturist may lose his season for second sowing, or he may again encounter a similar risk by resowing his land. Plans have been, and still continue to be tried, with partial success, and in consequence thereof they have been published to the world as unerring remedies ; but so long as the real economy of the creature remains unknown, it is impossible to arrive at any other conclusion than that such success has been obtained by chance, particular circumstances of locality or season having produced effects which have been attributed to some much more general cause, but which have been found totally inapplicable when those particular circumstances have ceased to exist.

Under these circumstances, the Doncaster Agricultural Association, in 1830, proposed the turnip-fly as an advantageous subject of inquiry, and a series of inquiries were issued, directed to numerous agriculturists and entomologists, seeking for information from both relative to the subject. A great variety of information, of a very valuable nature, was thus obtained, and from the published Report of this association, the following particulars are concisely derived :—It appears that although the months of May and June are stated as the period of the first attack, the insects appear much earlier, and are ready to attack the turnips first sown. It is evident, therefore, that the beetles have previously undergone their preparatory changes elsewhere than upon the turnip plant ; and this is an important fact, a point gained in the

* This insect is systematically described under the name of *Haltica nemorum*, Linnæus (by whom it was placed in the genus *Chrysomela*) ; it is of an oblong oval form, slightly depressed above, of a black colour, the elytra having a greenish tinge, and each being ornamented with a broad longitudinal stripe of a pale brimstone colour. It is about one-twelfth of an inch long. There are also several other species very nearly allied to it, having similar habits, and being not less injurious, some of which possess the pale stripe on the elytra, while in others it is wanting. They may all be distinguished by the thickened hind-legs.

economy of the insect, which has been too much overlooked. Again, it is stated that no period of sowing is too late, provided the weather be warm, for the attacks of the insects; hence the season for the ravages of the insect may be said to coincide with the season of vegetation itself. As to the stage of growth of the plant, it appears clear that the mischief is caused during the growth of the cotyledon leaves; if the plant is sufficiently strong to put on its second series of rough leaves, the insect, although it may continue its attacks, has not sufficient power to do much damage. It likewise appears that it is in hot, and especially in hot damp weather, that the insect is most prejudicial. As to soils, the correspondents agree that no soils whatever on which turnips can be cultivated at all are free from the insect; and in like manner no manure at present known will prevent its approach, although that manure which most effectually promotes the rapid growth of the plant, and the throwing out of the rough leaves, will at the same time be the most effectual defence against the insect.



Turnip Fly.

As to the mode of sowing to be adopted, the answers are decidedly in favour of the drill system over broad cast, by bringing the plant more immediately into contact with the manure, and by forcing forward the plants from the thickness in which they stand in the rows; and lastly, that regular management, and a high state of cultivation, are highly important in ensuring regular success, lands in the best condition escaping best. The turnip-fly, moreover, feeding also upon many hedge weeds, and sheltering itself in rough grounds, nothing would tend more effectually to prevent its accumulation than by early clearing off both its shelter and food as far as possible. Thus much is given as relates to the attacks of the insect, but of its natural history no decisive information was obtained by the Doncaster Agricultural Association. It is said that "this part of our inquiry is by far the most important; and, important as it is, cannot in the present state of information be fully answered." Can it be doubted that this is not the most important part of the inquiry? How is it possible that successful remedies can be applied whilst some persons assert that the insect is produced from eggs placed by the parent beetle upon the turnip seed, and others that it is thrown into the earth with the manure? The report proceeds: "Under these circumstances all speculations, as to the abode and habits of the infant turnip-fly, must be vague and unsatisfactory. We need not say how very important it is that these facts should be ascertained, and that we should know where the enemy is generated and nurtured, as well as the length of time occupied in each transformation. An extensive series of experiments undertaken on this subject might be of the utmost advantage, and eventually prove a national benefit. It is possible that in its infant stages the insect may be destroyed more effectually than in any other; and at all events an accurate

knowledge of these facts would confine the efforts and experiments of the farmer within certain limits, from which they must now, in our ignorance, be continually diverging, and much time and effort now wasted on impossible experiments would be saved." To this, therefore, the natural history view of the question, it is our duty to direct, in an especial manner, the attention of our readers.

It only remains for us to notice the most advisable remedies suggested for preventing or alleviating the attacks of the insect. Of such as relate to the steeping of the seed, or the mode of the sowing of the seed, we are silent, as it is quite clear, from what is known of the habits of the insect, that they are untenable, save as relates to the more quick forcing of the growth of the plant. An expedient which seems partially successful consists in sowing with the turnips the seeds of some other plant, which may be more grateful to the taste of the insect, as when Swedes and white turnips were sown together the former escaped. Fumigation and the burning of stubble on the windward side of the field has been found to answer, as has also the scattering of vegetable ashes or soot upon the plants; repeated watering of the plants also, where practicable, has been found successful; but the most universally practised method, and apparently much more certain of success, is to spread quick lime over the young plant, as soon as out of the ground, spreading it on and around the plant, and repeating it as often as wind and rain shall have cleared it off, until the plant be out of danger. Lime is so common that it can be had in all situations, and it is so cheap that the cost need not embarrass the farmer. The labour is so comparatively small that it is capable of being generally adopted, and if the fly should not appear the lime can be used for other purposes. It seems also to be advisable that the lime should be laid on in a hot state rather than after it is slaked. It would be easy and very desirable that it should be spread by some machine rather than by the hand. Some of the correspondents, indeed, urged an objection against this plan, that the quick lime injures the plant and prevents its growth, but from the more decided observations of others, the Association recommend "That as soon as the plant appears above ground it be dusted with quick lime, and this repeated as often as rain or wind beats it off, and the fly re-appears."

We had written thus far when we ascertained that the Entomological Society of London, by whom the turnip-fly had been selected as the subject for one of the prize essays established by the society, has just received an account of the insect in question, from the pen of Mr. Le Keux, in which an account of the preparatory stages of the insect is given. The particulars of this communication, read at the last January meeting of the society, have not indeed transpired, but we trust that the society will lose no time in laying before the public a document which may prove of such vast importance to the agriculturist.

HAMAMELIDEÆ. A small natural order, containing only two genera, and about half a dozen species. The *Hamamelis* is the Witch Hazel of North America; and the other genus is the *Fothergilla* from the same country, both hardy shrubs and common in our collections. Both are increased by layers. Little is known of the general properties of these plants. The bark of the *H. Virginica*, which is bitter, has been used medicinally; and poultices made of it are said to relieve inflammatory tumours.

HAMELLIA (Linnæus). A genus of West Indian evergreen shrubs, belonging to the class *Pentandria*, and to the natural order *Rubiaceæ*. This is an easily managed free-flowering genus, thriving in loam and moor-earth, and striking root readily from cuttings.

HAMITES (Sowerby). A shell only known in its fossil state; it may be considered a species of *Ammonites*; it is frequently found in the old formations, though generally as an imperfect mould. Both Sowerby and DeFrance have described many species.

HARDWICKIA (Roxburgh). A genus of lofty trees, natives of the East Indies, and belonging to *Leguminosæ*. Generic character: calyx of five sepals; corolla none; stamens alternately long and short; anthers oval with a point; style ascending; stigma headed; pod membranaceous, lance-shaped, and one-seeded. The plants affect rich loam and moor-earth mixed, and may be rooted from cuttings.

HARE (*Lepus*). A genus of rodent or gnawing mammalia. One of the most remarkable, the most natural, and the most numerous, and to man the most interesting of the whole class. The animals of this genus are distributed, in one species or other, over most countries on the face of the earth; and though New Holland forms a total, and South America a partial, exception, hares properly so called, or the allied subgenera, which agree well with them in their main characters, are found almost everywhere: in the warm countries, on the margins of the deserts, on the sandy downs by the sea shores, in the corn fields, in the upland wilds, and on the tops of the mountains, to the very verge of the never-thawing snow. In longitude they extend round the whole circle of the earth, and their range in latitude is at least from the Cape of Good Hope to the borders of the Polar ice.

Nor are the principal species held in less estimation as human food. In the British islands, the hare is now almost the only four-footed animal, the chase of which in wild nature is anything else than mere sport; and then of those species which live more in society than the common hare, and approach more nearly to a state of domestication, the numbers in favourable situations are so great, that large profits are made by the sale of them. This is especially the case with the rabbit. The warrens where those animals are encouraged, in general occupy situations which are not very fit for any other useful purpose; and the animals breed so fast that a supply or produce, equal to several times the number of the necessary stock, may be brought to market every year; and their successive breeding is so rapid under favourable circumstances, that rabbits are scarcely ever out of season, if the stock is properly managed; for as soon as one generation ceases to be fit for the market another is ready to come in. Some of the sandy islands in the bays and estuaries of this country are so perfectly crowded with rabbits that the inhabitants scarcely eat anything else; and they might make the same reply which the Shetland boy made to the third inquiry of the traveller respecting the colefish or "piltocks," which are the principal food of the labouring class in many of those northern islands. "Piltocks" was the answer to what was got for breakfast and for dinner; and when the question was put as to supper, the reply was, "What *could* I get but piltocks?" Just so might the people of some of the sandy islands

reply with regard to rabbits, more especially the people of some of the islets in the Bristol Channel.

The characters of this interesting and extensive genus are, four incisive teeth in the upper jaw, and only two in the under; six grinders in each side of the upper jaw, and only five in each side of the under. Those grinders are without proper roots, but have bony tubercles upon the surface, broader across the jaw than in the direction of it. The anterior one is a little smaller than those which immediately follow it; and the posterior one is still smaller. All these grinders, except the last one, have their crowns divided into two parts by a transverse furrow, but the last one presents only a few irregularities in the sides. The grinders in the lower jaw have their crowns divided in the same manner as those in the upper; but they differ from these in having the length along the jaws nearly equal to the breadth across it. By this conformation of the grinders the animals are enabled to masticate bark, twigs, and other very hard substances; because the grinders apply against each other in such a manner that every one bears upon two, which offers a much stronger resistance than if the action were that of tooth against tooth. The incisive teeth are long and large, and flattened on their external surfaces. Of the four in the upper jaw the two middle or principal ones are long, strong, and divided throughout their length by a deep furrow, the portions on each side of which are rounded externally; so that the cutting extremity of the tooth has something the form of a double gouge. Of those prominences the lateral or external one on each tooth is the broadest and strongest; and thus this apparatus combines the very maximum of mechanical skill and strength in proportion to the quantity of materials. The two shorter incisive teeth, which are external of these, serve chiefly to support them, which they do much more effectually than if they were of the same length. They are rounded in their section, and stand rather broad upon the jaw, by which means they still farther support the two middle ones. The middle ones have an oblique basil on their posterior faces, which brings them up to a chisel-edge on their anterior ones; and while the body of the tooth is composed of bone which is tough and fibrous, though comparatively soft, the plate of enamel on the anterior or cutting edge is exceedingly hard. This is by no means an uncommon structure of tooth among rodent or gnawing animals; and no structure can be better adapted for their purposes. This tooth wears at the top by the hard substances which the animals divide, and are compelled to divide, especially in the winter months, when there is no longer any green food for them. But though it wears, it has no tendency to get blunted, as the supporting bone wears fully as fast as the supported cutting edge; and as such teeth continue growing at the roots, they remain fit for action during the life of the owner. The two teeth in the under jaw have cutting edges, and are supported by bone nearly in the same manner as those in the upper.

The bodies of these animals are as peculiar and characteristic as the forms of their teeth. The fore legs are slender, and in all the species much shorter than the hind legs. The fore legs have five toes armed with claws, which are strong and rather crooked. The third toe is the longest in the foot, and the fifth, or that which answers to the thumb, is short, placed on the metacarpal bones, and does not touch the ground in walking. The hind feet have only four

toes each. All the toes, and even the soles of the feet, are covered with hair similar to that on the rest of the body; and this character has been considered as a distinguishing one from the earliest periods of natural history, and on account of it the genus has sometimes been called *Dasypoda*, or hairy foot. The tail, which is generally thickly beset with soft hair, is always short, and in some of the species is entirely wanting.

The ears form a distinguishing natural character in these animals; they are usually very long, and capable of much more motion than the ears of most other animals. In the natural state their common attitude is erect; but in some of the domesticated varieties (for the domesticated ones are very much broken into varieties) they are pendulous. In general the ears are naked, or very thinly covered with short hairs; and the membranes of which they are composed are so thin, that they are transparent or nearly so, at least a strong light shines through them. The upper lip is entirely slit or divided on the mesial line; and this is so marked a character, that the common name given to a divided lip is a hare lip. The external part of the mouth is partially covered with hair. The eyes are large, stand far out from the head, are placed laterally, and capable of commanding nearly the whole horizon; that is, seeing behind the animals as well as before without turning the head. The nostrils are straight; and in the upper part there is a transverse membrane which can occasionally be brought down, so as nearly to close the orifice.

The females have a variable number of mammæ, in the different species or rather subgenera. The greatest number is ten, and the least number six; and whatever the number is, there are always four pectoral, or on the breast, and the remainder abdominal or on the belly. In the hares and rabbits, which may be considered as the typical species, or the true hares, the number is always ten; and though it does not hold universally that the number of young increases with the number of mammæ, yet it is natural to suppose that the general tendency is that way.

We have already mentioned that these animals are exceedingly prolific; and the females of them are among the few in which the singular process of *superfoetation* takes place; that is, a new conception happens after the young one, already in the matrix, is considerably advanced. But though this does take place, all the animals of this genus are true placental mammalia, and have not in the system of reproduction, any approximation to the structure of the marsupial animals.

There is, however, one circumstance here which is not a little wonderful, and which shows that we are to seek the characters of animals in the whole animal and not in any individual part; that, in short, independently of the matter of which the body is composed, and the organs and the form into which that matter is moulded, there is something, even anterior to this matter and this form, which collects the one and fashions the other. The animals of this genus make a nearer approach, in their general form, their gait when walking, and their mode of life, to the rodent marsupial animals, that is to the kangaroos, especially the smaller ones, than is made by any other race, indeed than is made by any two races in the whole class of mammalia, the one of which is strictly placental, and the other marsupial. And in the kangaroos this tendency to superfoetation is far stronger

and more common than in the genus *Lepus*. So strong is it indeed that, when they are in free nature, there is perhaps no instance of a female kangaroo which has not two or more suecessions of young ones bringing forward at the same time. We shall have occasion to make some further remarks on this very singular portion of the economy of nature, when we come to the article KANGAROO, in the course of the alphabet; and we trust that before then we shall be in possession of two or three little points which are yet wanting, before the physiological history of those most extraordinary animals is complete. The present analogy is, however, of too striking a nature for being passed over without notice, and therefore we have introduced it to prepare such of our readers as may be fond of inquiring into the wonders of Nature's modes of working, for what we may have occasion to advance in the article above alluded to.

The hares admit of convenient division into two sub-genera; hares properly so called, *Lepus*; and rat-hares, *Lagomys*.

HARES PROPERLY SO CALLED (*Lepus*). These, besides the common characters of the genus, as already described, the hares properly so called, have certain characters of their own. One of these is colour, which, in a state of nature, is always greyish-brown, except in some of the Alpine species, and their colours appear to be climatal and seasonal. Another coloured mark, which distinguishes them in a state of nature, is a spot over or around the eye. In many this spot is white, in all it is lighter coloured than the surrounding parts, and it is never wanting. The tail is also invariably white on the under side, and generally blackish on the upper, except in the American rabbit, in which it is reddish. With the exception of the sides of the neck, the upper part, including the outsides of all the legs, is generally of the same colour as the back; the under part is white in almost all the species, and the tips of the ears are black; the body, the upper part especially, is covered with two sorts of hair, the one long and silky, and rather strong in the staple, the other shorter, more woolly, and much finer, and therefore extensively used in the manufacture of hats, in which it is frequently employed as a substitute for the fine woolly hair of the beaver, to which, however, it is greatly inferior, both in strength, and in retaining the colour given to it by dyeing. The hair of the rabbits is still greatly inferior to that of the typical hares in this respect, but it is also used, though hats made of rabbits' felt are of exceedingly little value.

The other remarkable character of the true hares which we shall mention is their extreme productiveness. They are capable of breeding during the first year; the females go only thirty days with young; the broods are often numerous; and the young are born completely covered with fur, with their eyes open, and are very soon in a condition for finding their own food. Many of the species dig burrows in the ground to a greater or less depth; and those who do not, are in the habit of selecting for themselves particular seats or "forms," upon which they rest, not only during a portion of the night, but during the greater part of the day. The morning and the evening are their principal feeding-times; and while the sun is bright they are but rarely seen, though, in gloomy days, and especially after a shower, they do come abroad, though the young do this more frequently than the old ones. On their forms they

sit very close; and as these are generally chosen upon dry knolls, or other places where there is withered vegetation, one may pass so near them as almost to tread on them without their rising. This is not only the case when there is no danger abroad, for there have been instances in which those who were following the greyhounds, in coursing, have picked up a live hare within a yard or two of where the dogs had passed not a minute before. The species are very numerous, but we can find room for only a few of the more remarkable.

THE COMMON HARE (*L. timidus*). It is scarcely necessary to describe the appearance of an animal so common and so well known; but the following may be regarded as a summary of the leading characters:—The inside of the mouth is hairy; the tongue and nose are very thick; the upper lip is cleft to the nostrils, which seem to unite, and to form a single opening; the eyes, which are very prominent, are furnished with a nictitating membrane; the feet are covered beneath, as well as above, with fur; the heart is proportionably large, and the cæcum about six times as large as the stomach. Under the Mosaic dispensation, when various animals were described as clean or unclean, according to the Levitical ritual, the hare is described as “chewing the cud,” that is, as being a ruminant animal. That the hare is not a true ruminant, and furnished with the compound stomachs of that class of animals, is certain; but still it says not a little for the truth of the Bible’s natural history, that the hare is still a partial ruminant, and that, while she sits on her form, she can occasionally bring up a portion of her food, and give it a second mastication. It might not be worth while to notice this fact, were it not that, on account of it, some persons have taken an exception to this part of the Bible. Hares, even of this species, are common in most parts of the world, though they vary considerably in size in different places. Generally speaking, they are smaller in hot countries than in cold; and we might expect this, because the general investiture of the whole body, feet and all, with fur, naturally points out the hare as more an animal of cold, or, at least, temperate countries, than of warm ones. It has been observed, however, that, in places not very different from each other, either in climate or in situation, there are great differences of appearance in the common hare. We shall afterwards have occasion to advert to the Irish hare, which recent observation has shown to differ greatly from the hare of Britain, near as the islands are to each other; but we may mention, that a very small breed exists in the island of Islay, on the west coast of Argyleshire, and a very large one on the Isle of Man, where individuals have been taken that weighed twelve pounds. In England examples occur of hares weighing from ten to eleven pounds; but from some of the rich districts in the east of England hares of much greater weight are frequently sent to the London markets, some weighing as much as fourteen and fifteen pounds. The kind provisions of nature, for the preservation of this race of animals, are equally numerous, and calculated to command our admiration, and afford a striking proof, among thousands which might be produced, of that system of compensations, that balancing of perfections and defects, that equalising of the quantity of life and destruction, on which the continued existence of the respective tribes of animals depends. On the one hand, if the hare is exposed to the

attacks of beasts of prey, on the other it is abundantly fruitful; and, if often pursued, it is also furnished with various sources of evasion and escape. Its ears are so contrived, as to convey even remote sound from behind; and the eyes, as already mentioned, of the class generally, are so situated as to enable it, when it rests on its seat, to observe without difficulty, and even without much motion of the head, a whole circle; and, though it sees but imperfectly in a straight line forwards, it can direct its vision to whatever threatens it in the way of pursuit, and the eyes are never entirely closed while the animal sleeps. From the powerful muscularity of its limbs, it can sustain the fleetness of its course for a considerable time, while the greater length of the hinder legs gives it such a decided advantage in ascending, that, when started, it always makes to the rising ground.

Its habitual timidity, and perpetual apprehension of danger, preserve it lean and in a condition the best adapted to profit by that speed which forms its security. In dry or frosty weather the thick hairy covering to its feet also gives it an advantage over the dog which pursues it. Its close approach in colour to the soil, often conceals it from the sight of man and predacious animals; and, in northern countries, its fur frequently becomes white in winter, so as scarcely to be distinguished from the surrounding snow. As if conscious of its resemblance to the earth on which it treads, it has frequently been known, when closely pursued by the hounds, to squat immediately behind a clod, and suffer the dogs to run over it, which they no sooner do than it instantly starts off in a contrary direction, and thus deceives them. As it possesses the sense of smell in a pre-eminent degree, it is often aware of the presence of an enemy before it can ascertain its danger by sight. The doublings of its course are familiar to every sportsman; and though its sagacity seems to be in some respects at fault, especially in exhausting its strength in the early part of the chase, and in returning to its resting-place by the same paths, it has been frequently observed to have recourse to stratagems, which in the human being would bespeak not only presence of mind, but a prompt and practical application of the reasoning principle. If undisturbed, the multiplication of hares would prove greater than that of most quadrupeds; for at all seasons they are capable of breeding, and from the first year of their existence, while the term of gestation does not exceed thirty-one days. The hunters allege that when the produce consists of more than one, each leveret is marked with a star-like appearance on the forehead, which usually disappears with the first shedding of the coat, but sometimes continues to a more advanced period. Sir Thomas Brown, in his “Treatise on Vulgar Errors,” asserts, from his own observation, that female hares frequently have in their ovaries, at the same time, young ones of different ages, and that after those which are mature are brought forth, those will remain, which are very far from the term of their exclusion. This phenomenon of superfœtation in the hare is confirmed by Buffon, who has explained it upon anatomical principles. However, the observation is at least as old as Herodotus. The breeding-place is usually under a tuft of grass, or high brake, a bush of heath, brush-wood, or standing corn. The young are suckled by the dam for about two weeks, after which they separate, and procure their own food, making their forms at sixty or seventy

paces from each other ; so that when we meet with one young hare we may be pretty certain of finding more within a very short distance. The hare arrives at maturity in one year, and is supposed to live eight or nine ; but it is presumed that a small number, comparatively, are allowed to die of old age, for dogs of all kinds pursue them by instinct ; the cat and the weasel tribes are constantly lying in ambush, and practising their wary arts to seize them ; while birds of prey are still more formidable enemies, as against them no swiftness can avail, nor retreat afford security ; and lastly, man, more powerful than all, sacrifices great numbers, for his pastime or his subsistence.

The hare is rarely found in very hilly or mountainous situations ; neither is it often found in places much exposed to the wind, especially when it blows from the north or south ; its favourite residence being in rich and somewhat dry and flat grounds. The hare-finders and shepherds remark, that the hares on the downs have a variety of seats, which they shift from time to time, as the weather directs, generally ascending to the more elevated grounds when rain prevails. Their food consists of various vegetables, but they seem to prefer those of a milky succulent quality, and to be very partial to pinks, carnations, parsley, birch, and laburnum. They will prey on the bark of almost every tree during winter, and they are often very injurious to young plantations. Their cry, which has been compared to that of an infant, is seldom heard, except in cases of distress or surprise. They are taken in some countries by a call imitative of that between the male and female.

The hare is naturally of a gentle disposition, although not very susceptible of strong attachment, and when taken young may be tamed with very little difficulty. Shy and timid as it undoubtedly is in its native haunts, yet, when domesticated, it often assumes a forward and even a petulant demeanour. In respect of disposition, however, a very marked diversity probably obtains among different individuals, as has been finely exemplified by Cowper the poet, in his account of three which he watched himself.

As an article of food the flesh of the hare has been in high esteem from very remote antiquity ; and notwithstanding the additions which modern luxury has made to the furnishings of the table, it still maintains its character. In the opinion of Martial the epigrammatic poet, the flesh of the hare was superior to that of every other four-footed animal ; and Horace represents the hare's " wing " as being among the most highly prized of Roman luxuries. In those countries of middle and southern Europe which are but thinly peopled and partially cultivated, as compared with the British islands, the number of hares which are taken in the course of the year is immense ; and the skins of them form an extensive branch of commerce, being exported for the hat manufacturer, and also used locally as very warm articles of clothing. It is understood that the small kingdom of Bohemia alone furnishes nearly half a million of skins in the course of the year, and that Austria Proper furnishes nearly double that number ; while the supply from southern Russia and western Siberia is understood to be still greater.

Though the hare is considered as one of the most harmless and timid of all animals, excepting in so far as it commits depredations upon the vegetable kingdom, it has not escaped being made an object of superstitious dread ; neither is it quite exempted from those

foolish, and perhaps instinctive, prejudices which certain individuals of the human race have against certain animals which cannot in the nature of things do them any harm. It is reported of a celebrated French commander, who was an exceedingly brave man, that he always fainted at the sight of a hare. In our own country, when the belief in witchcraft was general, the hare was regarded as one of the most formidable animals,—the one, in short, into which old women most frequently transformed themselves, by the instrumentality of the devil, in order to wreak their vengeance on the rest of mankind. Nor has this prejudice been entirely exploded, for there are still many of the fishing villages where a hare's foot cannot be mentioned without exciting the greatest terror,—where a hare thrown into a boat would prevent that boat from going to sea ; and where, if such a catastrophe were to happen as a hare to run along the beach in front of all the fishermen's huts, it would shut them up as effectually during the day as if each were guarded by a regiment of soldiers.

THE ALPINE HARE (*L. variabilis*). This is the only species of hare which is found in the British islands besides the common hare mentioned in the former part of this article. The present one is far from common in our islands, though by no means rare in some other parts of the world. It is found, however ; but we believe only on the Scottish mountains, the wildest and most remote of these, and never lower down than two thousand or fifteen hundred feet above the level of the sea. It is not so long in the legs as the common hare, probably because the places which it inhabits contains fewer enemies which can pursue it on the ground. It inhabits higher up than the locality of every predatory quadruped ; and running would be but a vain defence against the rush of the mountain eagle, which is the chief if not the only animal which this hare has to dread in the fastnesses of its mountains. The difference of length in the legs is about an inch in the fore ones, and nearly two inches in the hind ; so that it is an animal of more uniform course, and less disposed to leaping, than the common hare. In the body its dimensions are nearly the same ; and from the specimens which we have examined in their native localities, we are disposed to consider it as being altogether thicker and weightier than the common hares of the lowlands in the same parts of the country. One of the most remarkable peculiarities of this animal, and one in which it agrees with the ermine among mammalia, and the ptarmigan among birds, is the seasonal change of its colour, excepting one part, which remains constant during the whole year, and is its permanent characteristic colour as a hare ; this is, the tips of the ears are black at all seasons. In summer the colour on the upper part is dusky, more or less inclining to fawn colour, and sometimes dappled, at least in the intermediate seasons. In winter it is altogether white, with the exception of the tips of the ears as aforesaid. The following account of the changes of its fur is from the second volume of the Edinburgh Philosophical Journal, and we believe it is correct :—" The varying hare becomes white in winter. This remarkable change takes place in the following manner : About the middle of September the grey feet begin to be white, and before the month ends all the four feet are white, and the ears and muzzle are of a brighter colour. The white colour gradually ascends the legs and thighs, and we observe under the grey hair whitish

spots, which continue to increase till the end of October; but still the back continues of a grey colour, while the eye-brows and ears are nearly white. From this period the change of colour advances very rapidly, and by the middle of November the whole fur, with the exception of the tips of the ears, which remain black, is of a shining white. The back becomes white within eight days. During the whole of this remarkable change in the fur no hair falls from the animal; hence it appears that the hair actually changes its colour, and that there is no renewal of it. The fur retains its white colour until the month of March, or even later, depending on the temperature of the atmosphere, and by the middle of May it has again a grey colour. But the spring change is different from the winter, as the hair is completely shed." This species, even during the most intense cold which occurs in those elevated and northern regions of which it is a native, keeps up the character of the race in the rapidity of its circulation and the high degree of its temperature. Even there it is as warm as one hundred and five degrees of the common thermometer, which is nearly ten degrees higher than in the human body. True to this activity of its system, the Alpine hare never shows the least disposition to hibernate, or pass into a state of torpidity, even in the severest winters; and for great part of the year at least (its haunts have comparatively few visitors in the winter) it evinces nearly the same fertility and disposition to breed as those of its congeners which inhabit the most fertile places. It is altogether a very interesting animal, on account of the peculiarity of its haunts and the determination, or rather the adaptation, with which it braves the utmost severity and duration of the winter storms. In the winter months, even when the storms are most severe and the snow lies longest upon the ground, those hares do not descend to the low grounds, but reside in burrows under the snow. Those burrows are usually made near the root of some tuft or upland bush, by means of which a sort of chimney is kept open for the breathing of the animal, and it feeds upon the substance of the tuft. As it preserves its high temperature during the rigour of the weather, it also of course keeps up its rapid circulation, and requires a corresponding quantity of breathing and of food. All those circumstances go together in every animal; for in those species which sink into a dormant state during the winter, the temperature sinks at least nearly to the freezing-point in some of the species, though we are not aware of any warm-blooded animal that recovers if its internal temperature has been for some time below freezing. Under the snow, and with their thick and white fur, these animals have no uncomfortable place of residence. Snow, till it melts, is a bad conductor of heat; and therefore the shelter of unmelted snow is really warmer than that of a hole in the earth. The white fur of the animal prevents the escape of heat from its body to the snow around it, and the warm air which it gives out in breathing speedily mounts up in the colder atmosphere, producing comparatively little effect on the breathing chimney. In a sunny day, when the air is still and clear over the snow, the retreats of these animals can be discovered by the little column of steam which ascends from the breathing-chimney, and which forms a sort of miniature picture of the smoke from the snow-house of an Esquimaux. There are some characters which we omitted to mention, in which the Alpine hare differs from the com-

mon one. Among others, the ears are shorter in proportion; and the silky, or long fur, is of rather finer staple. The fur altogether is, however, the fur of a hare, and not of a rabbit.

THE IRISH HARE (*L. Hibernicus*). This animal has not, we believe, got a name of its own in general circulation, neither was it suspected to differ from the common hare until of late years, when the two were examined in juxtaposition with each other. So far as we are aware, this species is confined to Ireland, at least no mention of it has been made by any of the continental naturalists. The colours are very nearly those of the common hare; but it is smaller in size, shorter on the legs, has the ears shorter, and the head shorter and more rounded. Its fur too is tender and of little value, being much more like the fur of a rabbit than that of the hares of Britain. Indeed, though it is called the hare in Ireland, it appears to have altogether a good deal more of the rabbit character.

THE RABBIT (*L. cuniculus*). The rabbit, in a state of nature, is considerably less than the hare; the ears are shorter than the head; the tail is not so long as the thigh; and the whole action and motion of the animal less vigorous and fleet than those of the hare. The general colour in a state of nature is yellowish grey, with reddish on the neck and brown on the tail, with the throat and belly whitish. The ears are grey, and without any black on the tips. The rabbit is a native of warmer climates than the hare; and it is altogether an animal of different habits. The hare inhabits only where there is cover, at least to some extent, while the rabbit is met with in the open and sandy wastes. The hares never burrow in the ground, but the rabbits always do; and they live in solitude, while the rabbits are generally gregarious. Rabbits have been known from the earliest periods of history, and the first or earliest accounts which we have of them represent them as inhabiting the warm and sandy places of southern climates, especially those near the shores of the sea. We are informed by Pliny that Spain and Greece were those countries of Europe in which rabbits were first found; and it is related both by him and Varro that an entire town in Spain was overturned by the incredible number of rabbits which lodged under its foundations; and Strabo tells us that the people of the Balearic islands, apprehensive that their country would be rendered desolate by the vast multiplication of these creatures, sent deputies to Rome, to implore military aid against this novel description of enemies. The Spaniards, in subsequent periods, thinned their numbers by means of ferrets, which they had imported from Africa. It is asserted by Spallanzani, that when the crops were wasted in Basiluzzo, one of the Lipari islands, by an extraordinary increase of rabbits, the inhabitants had recourse to large importations of cats, which in a very short period of time entirely destroyed them. It is supposed that the species was originally confined to Africa, and was afterwards diffused over the warmer and milder parts of Europe and Asia. It has found in its introduction to America a climate more congenial to its constitution, and in consequence has very rapidly multiplied, especially in the more southerly countries of that continent. It does not thrive in Sweden in the open air, but requires the warmth of confinement. When only five or six months old, rabbits are capable of breeding; their term of gestation is thirty

or thirty-one days, and a vigorous female will produce about eight young rabbits seven times in the course of a year ; so that in the course of four years her progeny in theory would amount to one million, two hundred and seventy-four thousand, eight hundred and forty individuals. But we cannot average, in the first instance, the amount of fertility at the maximum ; and, secondly, as we observed in the history of the hare, the race is obnoxious to the attacks of men, and of various predaceous animals. If the dam does not find a hole suited to her purpose previously to her bringing forth, she digs one, not in a straight line, but in a zig-zag direction, enlarging the bottom of it every way, and pulling from her own body a quantity of hair, with which she makes a warm and comfortable bed for her young. The female during the two first days seldom if ever quits her young unless when pressed by hunger, at which time she eats with surprising quickness and returns immediately. When she ventures abroad she covers up the hole very carefully, scarcely leaving any perceptible mark of it, and conceals her charge from the male lest he should devour them. She continues these attentions for about a month, when the young are able to provide for themselves. She seeks to avoid all damp places, and prefers a light sandy dry soil to any other. The ordinary term of a rabbit's existence is from seven to ten years. On a dead level it finds it difficult to make its burrow, as, in such a situation, the mould must be thrown upward to the surface ; whereas, on the side of an eminence, the declivity affords a ready fall for the earth. As the rabbits on the island of Sor, near Sencgal, do not burrow, we are tempted to suspect that the digging of holes for themselves in colder climates is an acquired art, prompted by circumstances. This conjecture will appear still more probable when we reflect that domestic rabbits never give themselves the trouble of digging, and that when a warren is attempted to be stocked with a domestic breed, they and their offspring remain on the surface, and never begin to make holes for their protection until they have endured many hardships and passed through many generations.

It has been observed by Dr. Darwin, that as rabbits cannot articulate sounds, and are formed into societies living under ground, their method of giving an alarm is very peculiar ; for, when any danger threatens, they thump on the earth with one of their hinder feet, and produce a sound which can be heard by animals near the surface at a considerable distance. The females are the most vigilant sentinels, and remain without till all their companions have entered their holes. These animals are very sensible to any approaching changes of the weather, though habitually concealed under a thick covering of earth, and will seldom go abroad in the day-time unless it be settled and calm ; while their presentiment of a storm in the night-time impels them to rush out and quickly devour their stated fare, that they may be safely housed again before they are overtaken by the blast. It is customary, in stocking a warren, to make artificial burrows, of the diameter of the animal's body, with augers, for defending the rabbits against cold and vermin, till they make holes for themselves. The too great succulence of their diet should be corrected by a due mixture of hard and dry food, such as hay, barley, clover, oats, &c., to prevent scouring, which frequently proves fatal to them : the same precaution will likewise save them from dropsy, a complaint

which they are very subject to. A free circulation of air, and cleanliness, are the best preventives of a pining sickness, accompanied with an infectious itch, to which the young are otherwise liable. A dry regimen will, in general, remove the pustules which sometimes cover their liver ; and fresh air and litter are recommended for a disease in the eyes, which is apt to carry off the females after having suckled their young. As already mentioned, the fur of rabbits is used in the manufacture of hats, for which purpose the grey is usually taken. The lighter-coloured is dressed as fur, and dyed of various colours, in imitation of more valuable skins ; the wool also is sometimes spun for the purpose of being made into gloves and stockings ; but for whatever purpose it is used, it is tender, and therefore very unprofitable to the wearer. The pelt, or skin after the fur has been removed, is of a little more use. It is of small service as leather ; but it can be made into colourless glue of very good quality.

There are many varieties, that is varieties in size and colour, of hares, of which specimens have been brought from different parts of the world ; but it does not appear that there is any great difference in manners, except in so far as these are dependent upon difference of climate and food. We shall therefore give only a brief notice of a few of the more remarkable ones ; and, as generally applicable to them, we may mention that in the warm countries the species which keep more to the hills are more analogous to our hares ; and those which keep more to the low and fertile districts are more analogous to our rabbits.

BLACK-TAILED HARE (*L. nigricaudatus*). This species is American, and found in the extensive plains which lie to the northward of Mexico, and between that country and what may be regarded as polar America. The length of the head and body is about twenty-three inches, the head to the ears four inches, and the ears five. "The softness and general appearance of the fur resemble those of a rabbit rather than of a hare. The colouring of the under surface is separated from that of the upper by a distinct line about the middle of the side, which slopes upwards over the haunches to the middle line of the back. Behind this point, the white passing backwards along the middle line becomes more and more blended with black, until the colour of the upper surface of the tail is entirely black. The ears, which are longer than the head, are closely covered with short depressed hairs. These are in front mixed with black and yellow, giving a grizzled appearance ; on the hinder part they are entirely ochraceous for about two-thirds of the length of the ear, the terminal third as well as the tip and the hinder fringe being white, and furnished with much longer hairs. The long hairs fringing the anterior edge are ochraceous, excepting for a short distance immediately below the tip, along which space they are black." The specimen on which the above remarks were made by Mr. Bennett, before the committee of the Zoological Society, was obtained from California, a country of the zoology of which we knew little till lately. The mountainous parts of this country are in general covered with forests, and some of the trees are of immense size ; but still between the coast forests and the ridge of the stony mountains, there are plains of vast extent, on which there are no large trees, though plenty of bushes and herbaceous vegetation. In such places we may naturally expect a great number of rodent animals ; and as the rodentia

of the open fields in North America, and indeed of all the northern hemisphere, are chiefly of the genus *Lepus*, we may be prepared to expect several new species or varieties from this part of America.

THE TOLAI HARE, or SIBERIAN RABBIT (*L. Tolai*). This species is very abundant in the dry plains of Siberia, and in those of central Asia, as far to the southward as the northern slopes of the Himalaya mountains; but in the more southerly latitudes it keeps to the cold and elevated districts. In some particulars of its character it resembles the variable hares of this country, which with climatal differences extend more or less into the northern parts of both continents, and also along the mountain tops farther to the south. But although this species resembles the Alpine, Arctic, or variable hares, in a good many points, it has also no inconsiderable resemblance to the rabbits, and this in the texture of its fur, the form of its body, and its manners. When the Alpine hare is found in such situations as that chase can be given to it, it practices the same doublings and other manœuvres which are practised by common hares. The species under consideration, on the contrary, seeks for some retreat in holes of the earth or crannies of the rock, where its pursuer cannot reach it. Its size is about the same as that of the Alpine hare, and the general proportions of its members are not very different, but its head is straighter, longer, and more compressed. The upper part is mottled with grey and pale brown; the under part of the body is white, and that of the neck yellowish; the legs are yellowish, the tail black above and white on the under side; and the tips of the ears are black. It does not change its colour with the seasons, as is the case with the Alpine hare, but its general tint is paler in winter than in summer.

THE BLACK-NECKED HARE (*L. nigricollis*). This species is very common in the stony and bushy hills of central India; and the Mahrattas call it *Sussuh*, as is supposed from the whisking manner in which it escapes from their sight. The upper part of the body is mottled reddish, the flanks, the thighs, the shoulders, and the rump, mottled with greyish; the tail brownish grey above and white below. The outside of the fore legs, the throat, and breast, are reddish; the top of the head mottled reddish; the sides of the head grey; and the chin and under part of the body white. The ears are white at the bases, reddish in the middle, and blackish brown at the tips. On the nape and upper part of the neck there is a large patch of blackish brown, which extends some way down the back, and also round the sides of the neck, so as to form almost a complete collar. It is about the size of a large rabbit; and, besides being abundant in India, it is plentiful in the eastern islands.

There are numerous other species or varieties found in southern Asia; but they differ from each other chiefly in colour, and the manners of some of them are imperfectly known.

THE EGYPTIAN HARE (*L. Egypticus*) is about the size of a rabbit, but it has the ears longer in proportion than even the common hare. It is entirely of a fawn colour on the upper part, with very few mottlings; and this colour extends to the breast. The under part is white; the tail black on the upper part; the ears reddish brown with black tips. The eye spot bright fawn colour.

In Southern Africa there are several species, which are, generally speaking, redder in the colour than the

hares of most other parts of the world. The Cape hare is as large as the European one, and has the legs and the ears much longer; it is reddish grey on the upper part and white on the under, with the tips of the ears and the upper part of the tail black. The rock hare of Southern Africa is smaller, and resembles this one in shape; but its colours are much brighter, and in this respect it is usually accounted one of the gayest of the whole family. The sand hare is another species of Southern Africa, but, as its name imports, it inhabits places of a different character from those just mentioned: it has the habits of a rabbit, and is less in size than the rabbits of Europe, but its colours more resemble those of the Cape hares.

THE BRAZILIAN HARE (*L. Braziliensis*) is perhaps the smallest of all the true hares; and it is remarkable for the shortness of its fur, and still more so for that of its tail. In consequence of the almost total obliteration of the last appendage, it has sometimes been called *Lepus ecaudata*, or the tailless hare. Some describers of animals have confounded this with the guinea pig, which is found in the same parts of the world, but the two are perfectly distinct, and this one has the proper form of the hares and rabbits, although, in respect of size, it is a mere miniature. The length from the nose to the tail is about a foot and a half; and the tail, which is round and without produced hair, is about five-sixths of an inch more. The fur on the upper part is blackish brown and fawn, with reddish brown on the top of the head. The cheeks are of a greyish colour, with a light band passing over the eyes; and all the under parts are white. There are some coloured varieties; but the history of the species altogether is not very well made out.

These animals take after the hare rather than the rabbit in their manners. They live in the woods, and are not known in any instance to form burrows in the ground, though they sometimes take shelter in the hollows of trees. Their general habit, however, is to sit on tracks in the open places in the same manner as hares.

THE RAT HARES (*Lagomys*), of which a separate sub-genus is made, do not differ much from the sub-genus *Lepus* in those particulars of structure upon which the characters of genera and sub-genera are usually founded. Their teeth are the same, and so are their feet, in their general structure; but all the feet are more nearly of the same length, much less fitted for leaping, and the animals are much smaller in size. All the known ones are inhabitants of Siberia, where they spend the whole year without any climatal migration worthy of notice. As one means of enabling creatures so feeble, and having their average temperature so high, to exist, these animals have a great disposition to collect magazines of provisions against the time when the surface of a country in which the weather is so severe as it is in Siberia affords them little or nothing. Their principal characters are: the ears proportionally smaller than in the hares; the sub-orbital fossæ simple; the clavicle almost perfect, so that they have a cross motion of the fore feet, and can bring them to the mouth something in the same way as squirrels; the furrow in their large incisive teeth of the upper jaw is very distinct, and gives each tooth the appearance of being two; their cheek teeth are only five on each side; their legs are much shorter in proportion than those of the hares and rabbits; and they are altogether a much less important

race of animals. There are at least three species. The common name of all the species in the countries which they inhabit is *Pika*.

ALPINE PIKA (*L. Alpinus*). This species has been called the Alpine hare by Pennant and others, so that care must be taken not to confound it with the Alpine hare properly so called. Its general colour is reddish yellow interspersed with much longer hairs of a black colour. The part round the mouth is ash colour, and the under parts of the legs and the ears brown, the latter being rounded in their outlines. The length is only about nine inches and a half.

This species is very abundant in Siberia, where it is well known to the hunters, though Pallas was the first who introduced it properly to the notice of zoologists. It is found on the slopes of the steepest mountains, and even on the most inaccessible rocks; but in all situations they prefer the humid copses, in which, in rocky and mountainous places especially, they find abundance of herbage during the whole of the summer season. They are, strictly speaking, ground animals, and live indiscriminately in burrows excavated by themselves, in holes of the rocks, and in the hollows of decayed trees. They are not gregarious, but are found singly, or in pairs, or in families, according to the season. About the middle of August they begin to collect with great diligence and industry their store of provisions for the winter. This consists indiscriminately of the seeds of plants, of leaves, and of grasses, and they make their magazines in the earth, in the holes of rocks, or in the hollows of trees. These stores are not collected by each animal for itself; for, according to the number that may be in any particular locality, they unite in the labour of collecting the winter store; and it is understood that so true does the collecting instinct remain while the store lasts, that none of those who bore a part in the labour of collecting are ever excluded from their share of the magazine, neither can any stranger invade it, how severely soever necessity may pinch them. These magazines are often of very considerable magnitude, considering the small size of the animals. They frequently bear a considerable resemblance to a hayrick, seven or eight feet high, and about the same in diameter; and when they are of this size, the animals form a subterranean passage from their own dwellings to the store, by which they can find their way when the whole is buried under the snow. These animals do not, as we have hinted, commit any depredations upon the stores of each other, but they often do not come off so well at the hands of the Siberian hunters, who, when provender for their horses fails, often plunder these industrious little creatures.

Pallas examined, with that attention which he was in the habit of paying to all subjects connected with the economy of nature, the stores collected against the season of want by these provident animals. He found that they displayed wonderful animal sagacity, both in the plants which they selected and in the time at which they cut them down. There were no thorny plants or ligneous stems; and the whole appeared to have been cut down at that stage of their growth at which our grasses are understood to make the best hay. If grasses or other plants which are intended for this purpose are cut down too early, they are full of sap, which is not only tasteless, but which ferments and rots the whole when gathered into a heap. On the other hand, if the stems of annual plants stand till the grand labour of

the year is over by the ripening of the seeds, the stems which are left are sapless and afford but little nourishment. The pikas avoid both these extremes, and cut down their winter store when the juice of the stem has acquired its greatest maturity and sweetness. They avoid plants which are in flower; and indeed there are very few warm-blooded animals that will feed upon any plant in the time of its flowering. Pallas adds that, though they are comparatively few, those animals do mix with their more substantial food a few acid plants, or plants which have a pungent flavour of some kind or other, as if it were to give a zest or relish to the rest.

These harmless little animals are not only exposed to the peril of famine by having their stores plundered by the hunters, but they have other enemies besides the human race. The weasel tribe, which are very numerous in that part of the world, seek the abodes of the pikas with much assiduity, and kill them in great numbers; and, as is the case with many of the warm-blooded animals in those northern countries, they are much infested and tormented with the larvæ of insects. Still the destroyers, whether mammalia or insect, appear to be as necessary for the preservation of the animals under consideration as we find most predatory animals are for the preservation of their prey. The powers of life are in all the living productions of nature vigorous beyond the average of the means by which they can be supported. This, it should seem, is necessary for the full play of the system, and the surplus of one race is the means by which some other race is supported; and the wheel goes round till we find the most powerful of the predatory animals becoming, in their turn, the prey of the larvæ of insects apparently the most feeble.

THE GREY PIKA (*L. ogotonna*), is a native of the same countries. It is of a pale greyish colour on the upper part of the body, with the legs yellowish and the under part white. It is very common in those parts of Siberia which are situated near the lake of Baikal. It is an animal of the desert, or, at all events, of stony places, and does not come near those which man inhabits. Fond of sandy situations. The burrows are dry, shaped after the fashion of those of rabbits, but always with two entrances, and with these near heaps of stones; and in the bottom of these burrows they form for themselves comfortable couches of leaves and other vegetable matters. They are, to a very considerable extent, nocturnal animals, and not only so, but in their nightly excursions they seek the most lonely places. The mountain gulleys, and the narrow strips of land by the banks of rivers, where they are least likely to meet with enemies, are their chosen places; and secure in these, they nibble the fresh bark and buds of the shrubs. In summer they live upon the scanty vegetation which the arid wastes of Siberia produce. As is the case with the former species, they collect stores against the winter; and the people of Siberia look upon them as a kind of "weather-wisers," always concluding that the storm is at hand when those little animals collect their stores with more than ordinary diligence. They do not collect their stores into one great magazine, as is the case with the former species, but into a number of heaps of a hemispherical shape, and about a foot in diameter each, which may be seen near their burrows from about the month of September through the winter - but as the spring approaches

they disappear, and by the time that the snow is off the ground they are nearly gone.

They are very quick and active in their motions ; but they are so timid that they are not easily tamed, and in a state of nature they are so small and feeble that they are exposed to many enemies. During the day they are the victims of birds of prey ; and in the night, the time when in general they are most abroad, they are captured by lynxes, by martens, and by various others of the weasel tribe,

THE CALLING PIKA (*L. pusillus*). This is also a Siberian animal, and it is the smallest of the whole tribe, being only between six and seven inches in length, and weighing between three and four ounces. Its fur is very soft, close, and long,—brindled with brown and grey on the upper part, with the extremities of the feet dull yellow, the under part of the body dirty white, and the breast and lips the same colour but purer. The ears are triangular, and margined and pointed with white. The head is rather larger in proportion than in the other two species, but the animal altogether is very handsome, and its very minute size renders it an object of interest with the curious.

Like the others, it is a social animal, and burrows in the ground. Their burrows are in general deeper than those of the others ; and they are usually formed under bushes or tangled vegetation of some sort or other. During the day they are generally concealed in these subterranean retreats ; but they come abroad during the night, at which time they are understood to see as well as during the day. In the morning and the evening they call to each other with a cry which has been compared to that of the quail, and which, notwithstanding the small size of the animal, may be heard at the distance of more than a mile. It is on this account that the epithet “calling” has been added to their names. The uttering of this cry seems to be a matter of considerable exertion to them ; for it is attended with a motion of the neck and head very similar to those of the dog when he barks. When the weather is fine they are in general silent during the day, but when it lowers, or is tempestuous, they become noisy, and are, like many other animals, a sort of natural indicators of the weather. In the long winters of the country which they inhabit, they form galleries under the snow, by which they reach those shrubs on the bark of which they feed without at all appearing on the surface. In summer they eat grass and succulent leaves ; but they are often reduced to great extremities in the height of summer, when the moisture is dried up and the plants withered from the ground. In such cases they are sometimes reduced to feed on the droppings of the larger herbaceous mammalia ; and they are equally pinched for water, of which they drink freely when it is to be had.

These are very cleanly as well as very delicate little animals, and keep their burrows very neat. They are prolific, the females producing about six on the average. The time of gestation has not been ascertained ; but, from the analogy of the whole race, it is presumed to be very short. The young are produced with the eyes closed and without any fur on their bodies ; but the fur begins to appear about the eighth day, and the growth is very rapid. In their dispositions, these little creatures are the gentlest of all imaginable animals, and though, when in a state of nature, they are very timid, they are very

susceptible to kind usage, and even become very tame.

When awake, the sitting position is nearly spherical, and the animal about fills the hollow of the hand ; but in sleeping, the body is more stretched out. Like hares, they are leaping animals, but the shortness of the hind legs renders the leap rather slow and awkward ; and they are by no means swift animals upon the ground. From the perfect formation of their clavicles, they have a very free cross motion of the fore legs, and can readily bring them to all parts of their heads. They are, indeed, much in the habit of applying the feet to all parts of their fur, which, from its softness and the high temperature of these little animals, offers a very favourite nucleus for insects. One would be very apt to suspect that so small animals would be but ill prepared to bear the rigours of a Siberian winter ; the reverse is however the case. They not only remain in a state of activity during the utmost severity of the inclement season, but maintain when the air is far below freezing a heat of at least 104 or 105 degrees of the common thermometer. Altogether, these miniature hares are very interesting animals ; and they are not the less so, that they are peculiar to a region of the world which is peculiar both in its character and its productions.

HARE-BELLS. Is the *Scilla non scripta* of Linnæus, and one of the most beautiful and common British bulbous plants, growing plentifully in woods. There are two or three varieties of it in gardens.

HARPA (Lamarck ; *Buccinum harpa*, Linnæus). The whole of these beautiful shells were blended in the genus *Buccinum*, by Linnæus, under the name of *B. Harpa*. He appears to have considered them all of one species, but as a more intimate knowledge of malacology enables us to point out distinctive characters hitherto unknown or overlooked, the propriety of constituting a distinct genus of these molluscs becomes apparent, and they well deserve being thus honoured ; indeed it is difficult to reconcile to common sense from what cause the great naturalist jumbled together in his genus *Buccinum*, shells so totally different, even in their form, which was his principal, if not only rule, without we imagine the notch at the base of the aperture to have been his guide in this instance. One general character eminently distinguishes these molluscs, that of having longitudinal parallel ribs, which are compressed, sinuous, and sharp ; the upper extremity of each armed with one or more projecting detached points, giving the spire a coronated appearance ; the form of the shell is oval, more or less inflated ; the aperture, with a notch at the lower end of the canal ; the columella is smooth, flat, and pointed at the base, the last whorl larger than all the others united, the right side deeply excavated. It is doubtful if this mollusc possesses an operculum or not. Lamarck distinguishes eight species of this genus, all of which appear to inhabit the Indian Ocean. One species from the Mauritius has long been distinguished by collectors, in consequence of its relative rarity and very graceful configuration ; it is called the *Harpa imperialis*, and known by the trivial name of the many-ribbed, or many-ridged harp—a name so appropriate that Sowerby adopted it in preference to *H. imperialis* ; but excellent as *H. multcostata* is, it unfortunately interferes with the established usages of olden time, which have consecrated folly in more than one instance, and we are obliged to bow to custom in

defiance of good sense. This species of harpa is one of the many illustrative proofs of the value attached to every thing of great rarity, and its subsequent depreciation when more abundantly procured; it is within the writer's recollection that fine examples of this shell have been eagerly coveted by amateurs, at prices varying from five guineas to twenty guineas, such as may now be had equally select at three guineas, and such as will, doubtless, be obtainable, at no very distant period, for one-third that sum, or less. This shell is easily recognised from the other harps by the short interval between its periodical additions of growth, which constitute its designation, by forming a greater number of ribs or ridges (the labial terminations of the shell), which seem to indicate a more rapid development of the animal's organic structure than others of the same genus exhibit; this may possibly be accounted for by the local advantages of food or climate, since similar occurrences are observable in other genera of molluscs. Another characteristic distinction exists, that of a small spiral keel running round the summit of this species, which is never the case with others of the genus. The animal of this genus so much resembles that of the *Buccinum*, that its difference is only interesting to the anatomist; and we, therefore, will not here describe it. More than one fossil species of harp is described, but they are not abundant. De Blainville places this genus in the second class, *Paracephalophora*, first order, *Siphonobronchiata*, second family, *Entomostomata*, succeeding the true *Buccinum*, and preceding the *Dolium* and others of the same family.

HARPALIDÆ, or rather HARPALIDES. (See the article CARABIDÆ.) One of the chief divisions into which the great Linnæan genus of coleopterous insects, *Carabus*, has been divided by modern authors, distinguished by having the anterior tibiæ notched near the inner extremity, the elytra rounded at the extremity, the antennæ not elbowed, and the anterior tarsi dilated in the males. This is by far the most extensive group of carabideous (or predaceous land) insects; the species are of an intermediate size, between the larger *Carabi* and the smaller *Brachinides*. They are found upon the ground under stones, decaying leaves, and such like situations; they run with great agility, and many of the species fly well, especially in the hot sunshine. Many of these insects, whose habitations are in obscure situations, are dark coloured, the majority being of a shining black with pitchy or reddish limbs; hence some of the larger species have obtained in some parts of the country the name of black-clocks, and in others imps. Other species, however, which are to be observed constantly running about footpaths, and even upon the pavements in the heart of our metropolis in hot sunny weather, are, as might be expected from such a circumstance, more gaily ornamented, their colours being highly metallic and polished. In their habits they are essentially predaceous, feeding for the most part upon other softer insects, although it appears to be now clearly established (which was not the case when Mr. Stephens published his account of the group in question), that many of the species, chiefly belonging to the genera *Zabrus*, *Amara*, *Curtonotus*, &c., feed, both in the larva and perfect states, upon vegetables, the species of the first of these genera being occasionally very injurious to young wheat. The larvæ, which are longish, somewhat cylindric, and furnished with six legs, strong jaws, and a forked

tail, are scaly grubs, having the under surface of the body more fleshy than the upper, and reside in similar situations with the perfect insects, but are very difficult to rear to the beetle state. They feed, like the beetles, upon other larvæ and small insects. Mr. Stephens mentions a curious circumstance connected with these insects, worthy of more minute investigation than has hitherto been given to it. He says, "Many of the species are greatly infested with *Gordii*, a fact so generally known to the 'companions of my youth' that whenever an 'imp' was seen basking in the sun, it was immediately subjected to the ordeal of a pool of water for the purpose of ejecting the 'serpent,' thus called, from his lurking place." Owing to the great extent of the family and the great degree of attention which has been paid to it by the late French entomologists, it has become necessary to divide and subdivide it to a considerable extent, of which some idea may be entertained, when it is stated that this single family, comprising its various sections, genera, and species, occupies nearly three octavo volumes, in the work of the Baron Dejean. In a work like the present, we can of course introduce, and that but shortly, the chief divisions. These are

1. The *Patellimanes*, having the two anterior tarsi of the males dilated, the joints being square or rounded. Genera, *Chlænius*, *Epomis*, *Panagæus*, *Licinus*, *Badister*, &c.
2. The *Feroniens*, having the two anterior tarsi of the males dilated, the joints being heart-shaped. Genera, *Sphodrus*, *Calathus*, *Agonum*, *Zabrus*, *Steropus*, *Abax*, *Poecillus*, *Omaseus*, &c.
3. The *Harpaliens*, having the four anterior tarsi of the males dilated. Genera, *Anisodactylus*, *Harpalus*, *Stenolophus*, *Trechus*, &c.

The genus *Harpalus* is very extensive in British species, in which the thorax is quadrate, not punctate throughout, the upper lip entire, with the basal joints of the anterior tarsi of the females not dilated. The type is the *Harpalus ruficornis*, a very common species, generally somewhat more than half an inch long of a pitchy black colour, with the elytra opaque, and the legs and antennæ pitchy red.

HARPAX (Parkinson). A fossil mollusc, described by Parkinson in his Organic Remains, and closely resembling the recent genus, *Trigonia*. It certainly belongs to the family *Ostrea*; but scarcely appears to be sufficiently known to pronounce with certainty its rank in modern malacology.

HART'S TONGUE. Is the *Scolopendrium officinarum* of Smith, a common British fern. The *Polypodium phyllitidis* of Linnæus, another West Indian fern, is also called Hart's tongue.

HAWK (*Astur*), a genus of diurnal birds of prey, nearly allied to the falcons, and of which we shall not need to give a very detailed account, from the notice which we took of the family generally in the article FALCON. They belong to the section which in the days of falconry were called "ignoble hawks," though some of them were trained for sport, and when trained properly, highly esteemed, although they have not the dash and splendour of the long-winged, or noble falcons. One, the gos-hawk, when duly trained, was dignified by the name of the "falcon gentle."

Hawks are pretty numerous, and found in almost every part of the world, though there are some of the species which are not very clearly defined or well made out. They are sometimes designated short-winged, or low-flighted hawks, because in their style

of catching their prey, they do not fly so high, or get through the air with the same splendid action as the long-winged falcons. They are, however, stronger birds in proportion to their lineal dimensions; and they are, in some respects, intermediate between the falcons and the eagles. The falcons always strike their prey in the air; the eagles almost as invariably do it on the ground; and the hawks do sometimes the one and sometimes the other, according to circumstances. Some of them fly at a considerable elevation, and beat the ground to considerable distances; but they require a great deal of action and motion of the wings, and have much more "twittering" in their style of flight than the falcons, or even the eagles. In this respect they are perhaps the least graceful of all the diurnal birds of prey; for although they are more bold and powerful than either the buzzards or the kites, they have not the soft wing of the former, or the light floating and gliding motion of the latter. They are woodland birds, or, at all events, birds of the rich and lowland districts, rather than of the upland wilds; and the form of their wings, and indeed the whole of their powers and organisation accord with this.

Their characters are: the tarsi lengthened, so as to be longer than the middle front toe. The wings short and rounded, and thus better adapted for frequent ascent and descent than for long-continued forward flight. The first quill of the wing is much shorter than the second, and the third is very nearly equal in length to the fourth, which is the longest in the wing. The middle front toe on the foot is longer than any of the side ones; and the claws are very crooked and sharp at the points. They still, however, preserve the true character of birds which kill prey and eat it in the recent state, in the form of their beaks, which are curved from the base, and more decidedly flesh-cutting beaks than those even of the eagles.

The specific distinctions of hawks are matters of very great intricacy, especially those of countries which are little known, and where, in many instances, a single specimen of the bird is all that has been seen, and that not always by persons capable of forming an accurate judgment respecting it. This difficulty arises, in great part, from the variety of colours to which most birds of prey are subject, at different ages and in different situations. We might expect this in birds which are rapacious, which find their food with considerable labour and exposure to the elements, and which, though discursive in their localities, are not migrant. The general rule we believe is, that as they advance in years they become paler in their colours, and at the same time increase in size and in strength. This is evidently the origin of that allegorical allusion in which the eagle is said to renew its age; for not the eagles only, but all birds of prey, at least all diurnal ones, acquire a different character and plumage at more advanced periods of life than most other birds; and though these are changes and not renewals, each change may be said to be one from greater to greater power in the bird.

As is the case with falcons and eagles, the most powerful hawks are found in the cold latitudes; but they are not so much birds of the mountain, the storm, and the free sky, as the falcons and eagles are. They inhabit hilly countries, where there are woods; and their short wings and facility of ascending and descending, enable them to find their prey in places

where there is no scope either for the stoop of an eagle or the rush of a falcon. Generally speaking, they build more in trees than birds of the two genera which have been mentioned, and between which they are in many respects intermediate. Their bills are not so decidedly notched as those of the falcons; and their claws are more slender in proportion to the length, more curved, and therefore unite a clutching or carrying character along with the killing one.

They admit of subdivision into two sections, which may from the British species, which are the typical ones of the two, be styled Gos-hawks and Sparrow-hawks; and considering the difference between hawks and falcons as we have pointed them out, the gos-hawks may be considered as resembling the ger-falcons, and the sparrow-hawks the common falcons.

The gos-hawks are by much the stronger birds of the two; but they are at the same time heavier, and perhaps not so courageous in proportion to their strength as some of the sparrow-hawks. They have the tarsi short and thick, and covered with shielded scales, and are most abundant in the wooded parts of hills. The sparrow-hawks have the tarsi longer and more slender, and inhabit more the lowland countries, though they also are most abundant in wooded districts.

THE GOS-HAWK (*A. palumbarius*) is unquestionably the finest of all the hawks; and in those days when hawking was a royal and noble sport, it was much used for low game, that is, game keeping on the ground or near it, such as hares and rabbits, wild ducks, partridges, and other ground birds, which rarely take the sky to any great height. It is longer than the ger-falcon, but the greater length is in the tail-feathers; the wings are considerably shorter and more concave than those of the falcon, and thus it is not seen resting on the air, as is often the case with that bird. It is also less elegant than the peregrine; and after one has seen the flight of falcons, that of even a gos-hawk appears a very inferior and secondary matter. The short hollow wings give it the appearance of getting on with great labour; and though, from the character of its game, which, when winged, is usually shorter winged than itself, it is pretty sure of its prey, it makes but poor work if thrown off at a long-winged bird in forward chase. In consequence of this, powerful as it is, when it comes in the neighbourhood of air-birds, such as swallows, they drive at it in all directions, and so perplex and annoy it, that it turns craven and sneaks off to the hills or the woods.

The female in this, as in all the other birds of prey, is by much the finer bird. When full grown, the general colour of all the upper parts, the ear-coverts, and a streak continued thence to the shoulder, is blackish brown; the back mottled, the tips of the ear-coverts relieved, and the quills of the wings and tail-feathers edged with faint tints of a reddish brown colour. The space between the nostril and the eye is grey, and the rest of the under part white, with lines of brown and numerous arrow-head spots, which are very delicate on the long feathers of the legs, and scarcely observable on the vent and under tail-coverts. The tail and tail-feathers are obtuse, pointed, and edged with white. Though the colours are not showy, they are very well contrasted. The irides are grey, the naked parts yellow, with a very quick and penetrating eye. In the male bird, the top of the head and the neck is much lighter, and there is a reddish tinge over the greater portion of the body. He

also has fewer spots on the under part, which are generally oval-shaped and much paler. The female is a much superior bird, being better shouldered or winged, and at least a third larger in size. The eggs of the gos-hawk seldom, if ever, exceed four in number. The young are much more of a red colour on



Gos-hawk.

the under parts than the mature birds. They go through a variety of tints of plumage, and, as is generally the case with birds which do that, the standard colour which they at last have is not uniform. The gos-hawk is sometimes nearly white, and at other times tawny, with a few markings, especially the males. This species of hawk, varying in appearance, as is stated to be general with the race, is very extensively distributed over the northern parts both of the eastern continent and of America. It is not found in the extreme north of either; and in the warmer regions it gives place to feebler hawks; but it extends almost to the northern extremity of Europe, to Iceland, and to the Faroe islands. In Asia it does not reach to so high latitudes as it does in Europe; but it extends farther to the south, being common in the hilly parts of China, and still occasionally used by the Chinese in hawking. In England it is so rare, that it can hardly be said to be regularly resident in any part of the country, except, perhaps, some of the wild hilly districts in the north; in Scotland it is more abundant, though even there it is by no means a common bird; and its haunts are local and peculiar. In the rich parts of the lowlands it is hardly known as a resident bird, and rarely seen as a visitant; but in those districts of the Highlands, where remnants of those natural forests which once covered great part of the country are still preserved, there is a greater chance of seeing the gos-hawk. Even there, however, it is to be seen in wild places only; for it shuns the habitations of men, and even the pastures of sheep and cattle. The margins and openings of the woods are its principal places of resort; and its food consists of the smaller mammalia and the larger ground birds. Before the general introduction of sheep into the Scottish uplands, the gos-hawk was more abundant than it is now, and committed very considerable ravages upon the mountain game; and it is doubtful whether the sheep, which certainly do occasionally trample on the nests and break the eggs, may not on the whole be a preserver of grouse on the hills. It may seem singular that a hawk, and a powerful hawk, should avoid places where sheep are pasturing, be-

cause they have neither the disposition nor the power of offering it the smallest injury; but it is a general truth that all birds of prey shun every living creature which does not come within the range of their usual game in its external appearance, and this is one strong proof that such birds seek their prey only by the eye.

There are a vast number of other species, agreeing more or less with the gos-hawk in its principal characters, to be found in various parts of the world, and as far to the south as New Holland, and the extremity of South America. Little is known, however, of their manners, and, so far as these are known, they resemble the manners of the common gos-hawk; and, therefore, the enumeration of them would be a mere list of names, without any interest to the general reader. We shall, however, mention one American species, from the singularity of its common English name.

THE LAUGHING HAWK (*A. cachinnans*). This species has the legs and cere yellow; eyelids white; the body variegated with brown and whitish colour. The top of the head is black, and surrounded by a white ring. It is a native of Paraguay, Cayenne, and other parts of South America, haunting those savannahs which are flooded and marshy grounds, and perching on dried and elevated branches of trees, whence it is conjectured to feed on fish, lizards, frogs, and other reptiles. It is rather a stupid bird, occasionally uttering a sound, which is expressed by its vernacular appellation, and, when disturbed, giving a shrill and sudden cry, as though it were laughing. Its manners are much more soft and gentle than those of the gos-hawk; this is indeed a general character of all the birds of prey in the warm regions, and it is worthy of remark as pointing out how nicely the energies and resources of animals are adapted to their places on the globe. A hawk which suits the comparatively warm and uniform climate of tropical America would be but ill adapted for those buffetings by the storm to which such a bird must submit in a northern part of the world; and, on the other hand, the greater strength, spirit, and power of endurance which those northern species possess, would be thrown away upon an animal of warm climates, which would never have occasion to bring them into use. It is in such analogies that we see the beauties of nature, and receive the most irresistible proofs that the whole of it is one in design and in execution; and that perfect knowledge of the whole must have existed on the part of the Author before any part of it was called into existence.

We shall now mention an example of the sparrow-hawks, which differ from the gos-hawks in the manner formerly stated. They are birds of lighter make, more constantly on the wing, much more daring, and do not, as is the case with the others, flit before the progress of cultivation.

COMMON SPARROW-HAWK (*A. nisus*). In all the richer and more lowland parts of Britain this species is "the hawk;" or, if any thing additional in the shape of a bird of prey is seen in such places, it is one of the smaller falcons. Like the gos-hawk, the sparrow-hawk is very generally distributed. The male sparrow-hawk weighs about five ounces, and the female about nine; the former measures about a foot in length, the latter about fifteen inches. The bill is bluish, and dusky at the point; the cere yellow; irides bright orange yellow; the plumage of the upper parts, in some of both sexes, are of a deep

bluish grey ; in others brown, edged with brownish red ; the under parts of the female are more fully marked with minute undulated lines of deep brown ; the male is inclined to rust colour on the breast, which in the other is whitish ; on the back of the head, in both sexes, is an obscure broken patch of white ; the quills dusky, barred with black on the outer webs, and spotted with white at the base of the inner ; the tail, like the back, with broad bars of dusky black, the extreme point whitish ; the legs are yellow, long, and slender.



Sparrow Hawk.

The sparrow-hawk is well known for the extent and boldness of its depredations on poultry-yards, and the immense number of birds which it kills and eats in the fields and copses ; but though in boldness, and slightly in its style of flight, it has a trace of resemblance to the smaller falcons, its general nature and habit are totally different. The falcons, if their prey is not killed by the stroke, instantly kill it outright, by breaking the skull or dislocating the neck before they begin to eat ; and this is also known to be the case with the typical eagles ; for, though those eagles which have a strong trace of the vulture in them begin eating their living prey as if it were carrion, the "respectable" eagles never touch theirs with the beak until the gripe of the talons has put an end to its life. The sparrow-hawk has also this habit, and begins to pull feathers and tear away at its prey while that prey is still alive. It is probably on this account that the falconers first drew the distinction between noble and ignoble hawks ; for we associate a degree of cruelty with this mangling and eating of the living animal, which we do not feel when the prey is killed outright before it is eaten ; and there is more than mere sentiment in this distinction, inasmuch as, though death is the final result in both cases, there is a cruelty of a degrading character in death by protracted torture. The female sparrow-hawk builds her nest in lofty trees, ruined castles, elevated rocks, and other places, and she stands accused of sometimes appropriating the deserted nest of the crow, or rather of the rook. The eggs are from four to six in number, of a dull white colour, and sometimes of a bluish tinge, blotched at the large, and sometimes, though very rarely, at the small end, with rust colour. Though it flies low, it

is very fierce and predaceous. It abounds more or less in every quarter of the world, being found as high as Lapland, and in the Faroe Isles, though not, as alleged, in Siberia, and again as far south as Africa. It is common in most of the wooded and inclosed parts of this country, but is of less frequent occurrence in the more champaign districts. It seems to be a partial migrant in some parts of Europe ; for Bcton, long ago, witnessed their passage, as Sonnini more recently did, when at sea, between Barbary and Italy. On the approach of winter legions of them move southward, to the dismay of the smaller and weaker migratory birds, on which they prey with cruel assiduity, and from which circumstance the mariners in the Mediterranean give them the appellation of "corsairs." They are stationary in Egypt throughout the year, and many of them are habituated to a town life, usually taking up their residence along with vultures and kites on the terraces of the houses, and sparing, as if by implied contract, the turtle-doves. Indeed, we should remark that, notwithstanding its bold and ravenous propensities, the sparrow-hawk is more easily tamed than most birds of prey, and not unsusceptible of attachment. It is alleged that the young birds are very good eating, and that they are used as food in Egypt. A case of the domestic economy and habits of this species of hawk is so well told by White, in the Natural History of Selborne, that we cannot resist quoting it. "About the 10th of July," says he, "a pair of sparrow-hawks bred in an old crow's nest on a low beech in Selborne Hanger, and as their brood, which was numerous, began to grow up, became so daring and ravenous, that they were a terror to all the dames in the village who had chickens or ducklings under their care. A boy climbed the tree, and found the young so fledged that they all escaped from him, but he discovered that a good house had been kept ; the larder was well stored with provisions, for he brought down a young blackbird, jay, and house-martin, all clean picked, and some half devoured. The old birds had been observed to make sad havoc for some days among the new-flown swallows and martins, which, being but lately out of their nests, had not acquired those powers and command of wing that enabled them, when more mature, to set enemies at defiance."

THE MUSICAL SPARROW-HAWK (*A. musicus*).

This is an African species, and it is remarkable as being the only bird of prey that possesses a musical song, or which has a voice at all agreeable to the ear ; for, though there are different sounds among the others, they have little or no modulation, and are generally harsh and screaming. The sound uttered by the goshawk in the breeding season is a slight exception to this, for at that time it utters a sort of whistle ; but though this whistle is clear and piercing, it is not modulated. The song of the present species is, however, described as being sweet. It is given by the male only, as in the singing birds, and during the breeding time ; and, while giving his full melody, the bird is said to be so much absorbed by it as that he may be approached within a few yards. We are not very well acquainted with the whole of the domestic habits of this singular bird ; but Levaillant, who observed it in the woods of the interior of Africa, mentions that, though an exceedingly shy bird at other times, the male may be approached while singing, with the greatest ease, and watched and observed while the song lasts. According to the

same authority, the female bird is particularly grateful for this music; and it is natural that she should, because she, of all the order, is the only female whose mate serenades her with an agreeable song. Some of the owls, indeed, do their best in the way of noise, but there is not much music in their hooting. The female shows her attachment very strongly in the event of the male being shot; while singing is of course the time for doing this; and if it is done, the female instantly flies to the place where the male was perched—for he sings from the perch only—and if she does not spy the body, she continues to fly round and round for a considerable time, uttering the most subdued and mournful cries; and so much is she absorbed by her sorrow, that on these occasions she, too, becomes an easy prey to the fowler. Of course it is only for specimens, to serve the purposes of science or of curiosity, that such birds as these are shot; and where so much attachment is shown among animals, of which our general feeling is so very different, one almost regrets that they should be destroyed for any purposes except the most urgent ones. It does not appear that the male shows so much affection; for, if the female is shot while the male is singing, he continues his song a little, and then flies off. This species is about the size of the peregrine falcon, and more handsomely formed than the common hawks. The general colour on the upper part is grey, with brown undulations on the under part; the quills, which are of a short character, are black; and the tail, which is wedge-shaped, is brown, crossed by bars of white; the form of the wings and tail point out the species as a bird of the woods, where it lodges and nestles, the eggs being four in number, of a white colour, and nearly round. They are bold birds, and commit great depredations on quails, partridges, and other ground birds; they also attack hares and rabbits; and, when other prey is not to be had, they have recourse to mice and reptiles.

THE DWARF SPARROW-HAWK (*A. minutus*). This is also an African species. It is described as being brown on the upper part and white on the under, having the breast marked with longitudinal streaks of brown, and the belly with cross bars of the same colour. Though small in size, not exceeding the common blackbird, this species is daring. It not only drives off the more powerful of the dentirostral birds, such as the larger butcher-birds, but it attacks the kite and the buzzard. Crows are, however, the most marked objects of its persecution, for it chases them with eager impetuosity, uttering a cry which has been compared to that of the kestrel. The lesser birds are its ordinary food; but when a sufficiency of these cannot be procured, it has recourse to some of the larger sorts of insects, particularly of the mantis and locust tribes. The female, which is nearly double the size of the male, but with plumage of duller tints, forms its nest, in rather a coarse style, of small twigs, intermixed with leaves and moss, and lined with leaves, wool, or moss, and lays in this from four to five eggs. As Levaillant was sitting at a table, engaged in preparing some birds lately killed, one of these hawks suddenly stooped, and, seizing one of the recently-stuffed specimens, and flying to a neighbouring tree, began to pull the feathers, and tear it open, but, finding nothing but moss and cotton, seemed indignant at the disappointment, and at length contented itself with devouring the head, the only part which remained in its natural state.

HAWKMOTH. The English name given to a very extensive primary section of lepidopterous insects which formed one of the three genera into which that order was divided by Linnæus, *Sphinx*, distinguished by a robust body, prismatic antennæ, and strong wings, which do not extend to the extremity of the abdomen. They are generally of a large size, indeed the species found in this country are by far the largest lepidopterous insects which we possess. Their colours are generally agreeably varied, the under wings being often banded. Owing to their strength of wing, their flight is very strong, whence the ordinary English name; during flight, moreover, they produce a strong humming noise, which renders their approach easily perceived. They dart about with the greatest rapidity from flower to flower, preferring those that have long and tubular corollas, into which they introduce their long and spiral tongue, by which they are enabled to reach the honey at its base; whilst thus employed, they remain as it were suspended in the air in front of the flowers, their wings being kept in a long sustained hover. That delightful describer of every thing rural, Miss Mitford, has so well noticed the motions of one of these insects, in her truly national "Our Village," that we are tempted to extract a short passage. She is describing her garden, in which she traces "the gay gambols of the common butterflies as they sport around the dahlias, or watches that rarer moth which the country people, fertile in pretty names, call the bee-bird*"; that bird-like insect which flutters in the hottest days over the sweetest flowers, inserting its long proboscis into the small tubes of the jasmine, and hovering over the scarlet flowers of the geranium, whose bright colour seems reflected on its own feathery breast; that insect which seems so thoroughly a creature of the air, never at rest, always when feeding self-poised and self-supported, and whose wings in their motion have a sound so deep, so full, so lulling, and so musical; nothing so pleasant as to sit amid that mixture of the flower and the leaf, watching the bee-bird."

The caterpillars of these moths vary considerably in their forms, especially in the anterior part of the body, in some this part is susceptible of great elongation like the trunk of the elephant, whence those species have obtained the name of elephant hawkmoths. This motion is effected when the insect is feeding and in search of food, at which time the neck assumes a narrow conical form, truncated in front, the head and face forming the truncated part; when in repose they withdraw this elongation, so that the front of the body then seems clavate. Other species do not possess this peculiarity, but elevate the anterior part of the body even as far as the first or second pro-legs, assuming an attitude like that of the fabulous sphinx, as represented in our article CATERPILLAR. The last segment but one of the body is furnished with a horn, which varies considerably in form, in some being straight, slender, and smooth, in others, as in the death's-head hawkmoth, being curved and very rugose, whilst in others it is linear and not persistent, existing only during the early stages of the caterpillar's existence, its place being subsequently occupied by a very small eminence. In the sphinx *Hippophaes*, an inhabitant of Dauphiny, the larva,

* In a note this insect is said to be the *Sphinx ligustri*, or privet hawkmoth, but it is evidently intended for the *Sphinx stellatarum*, or humming-bird hawkmoth.

either to avoid the glare of light or the attacks of enemies, hides itself during the day time beneath the dead leaves lying at the roots of trees, coming forth to feed only at night. The caterpillars of the hawkmoths are smooth, and furnished with sixteen legs, the ten posterior being termed pro-legs; they are of a cylindric form. They live solitarily, and feed upon the leaves of vegetables, eating much at a time and then making a long fast. They are at first very active, and, when approached, fall from the leaf upon which they were placed, suspending themselves by a thread; when more aged they become very sluggish, moving only the head or the hind part of the body. It is in the earth or upon its surface covered with leaves that they undergo the chrysalis state, and make their cocoons, which, however, contain but little silk. In those species which have the proboscis very long in the moth state, the chrysalis is furnished with a curved appendage at its breast, in which the proboscis is rolled up. The chrysalis state generally lasts seven or eight months, but in some species (including the giant *Atropos*) it does not exceed a fortnight. In general there is but one generation during the year, but the humming-bird hawkmoth (*Sph. stellatarum*) is found in the perfect as well as in the larva state from the spring until the first frosts of winter. See, for structural and sectional details, the article SPHINX, as well as those upon the DEATH'S-HEAD HAWKMOOTH and DEILEPHILA.

HAWKWEED is the *Hieracium Alpinum* of Linnæus, one of an extensive genus of herbaceous plants, common in every dry pasture all over Europe.

HAWORTHIA (Duval). An extensive genus of succulent plants, natives of the Cape of Good Hope, and separated from the genus *Aloe* by Duval. The *Haworthias* differ in habit from the generality of the Aloes, and there is also some difference in the form of the corolla.

HAWTHORN is the *Cratægus oxyacantha* of Linnæus, one of our common hedge plants, and much admired for the beauty and scent of its flowers. There are several rich coloured varieties in the gardens.

HEART'S EASE is the *Viola tricolor* of Linnæus, a common British plant, of which numerous varieties are in the gardens, and now ranked as a florist's flower. See VIOLARIÆ.

HEART SEED is the *Cardiospermum corindum* of Linnæus, a genus of climbing plants mostly found in tropical countries.

HEATH is the common name of that beautiful family of alpine plants called by botanists *Erica*. They inhabit the northern, and a few of the loftiest hills in the south of Europe; but their grand habitat is on the southern promontory of Africa, where thousands of acres are covered with heaths in incredible numbers, and with hundreds of different species, above six hundred of which are already described.

HEBENSTREITIA (Linnæus). A genus of undershrubs indigenous to the Cape of Good Hope. Class and order *Didynamia Angiospermia*, and natural order *Verbenaceæ*. Generic character: calyx of one leaf, tubular, emarginate, opening lengthwise below; corolla, a cylindrical tube, limb one four-cleft lip; stamens inserted into the throat of the corolla; filaments short; anthers incumbent and bursting transversely; style filiform; stigma simple; seed-vessel membranaceous, one-celled, two-valved, and two-seeded. Greenhouse plants, and propagated by cuttings.

HEDERA (Linnæus.) A genus of plants, the

H. helix being the well known ivy. There are only three species of the genus as yet in the books; one found in the Canary islands, and another in Jamaica. The British species is found everywhere in woods, and has several remarkable characteristics; though destined to creep on the ground, it steals a permanent support from whatever is higher than itself; thus far it is a parasite, but it extracts no aliment from its supporter. Its embrace, like that of the *Boa*, is sometimes fatal; it is an aspirant as long as there is any thing to surmount, but becomes stationary when it has reached the topmost point. It is indispensable in picturesque scenery; it clothes and supports in its turn the tottering wall. Its berries afford a rich repast to numerous birds, and its melliferous flowers to swarms of insects, and yet its leaves are disrelished by every caterpillar, however voracious, but eaten greedily by sheep, by which, were it not for its climbing tendency, it would be quickly extirpated if approachable by the flock. Sheep suffer, however, for their temerity in denuding the ivy, as it causes a premature shedding of their fleece early in the spring—so say the shepherds. The ivy is sacred to the owl, the wren, and many other birds. There are several varieties, among which the Irish is conspicuous.

HEDGEHOG (*Erinaceus*). A very singular genus of insectivorous mammalia, belonging to Cuvier's great order *Carnassier*, and, in the structure of their teeth, the least carnivorous, perhaps, of the whole order. The most striking external character of these animals is the spines with which their bodies are covered, and this has been taken as a popular ground of classification; and the name hedgehog, or urchin (*Herisson* in French), has been applied to other spiny mammalia, such as the porcupines, which are rodentia; to the *Deodin* among fishes; and to the *Echinus*, or sea-egg, which is a zoophyte, belonging to the pedicellated echinodermata. The proper hedgehog, however, belongs to the flesh, or animal-matter eating division of mammalia.



Hedgehog.

This is a very peculiar genus in the structure, in appearance, and in manners; and though the form of their teeth, and various other structural particulars, throw them into different parts of the system, hedgehogs appear, in their general relations to the system of nature, to occupy nearly the same place in the northern countries as the armadillos do in South America; and it is not a little remarkable that two races, adapted for acting a similar part in countries so unlike each other, should both have a hard covering on the upper part of their bodies, though the covering of the armadillos consists of flat plates, and that of the hedgehogs of detached spines.

The generic characters of the hedgehogs are: the cutting-teeth slender, and sharp-edged or emarginated; the canines weak, and shorter than the cutting-teeth, so as scarcely to be distinguishable from the false

grinders ; the grinders are furnished with tuberculated crowns ; the snout produced and pointed, terminating in a cartilage, with an indented appendage, something like the comb of the cock, on the external margin of the nostrils ; the body contracted, and covered with short and strong spines, intermixed with hairs ; the legs short, and furnished with five toes each, armed with digging claws ; the body capable of being rolled up into a ball at the will of the animal, and, when this is done, the spines stand out from it in all directions ; the fore legs are furnished with clavicles, so that they have a cross motion. The females have more than two mammæ, none of which are seated on the breast.

These animals are generally of small size, and obscure and timid in their modes of life. Their principal food is worms, the larvæ of insects, ground mollusca, crickets, and beetles, and sometimes the farinaceous roots of plants. So far as is known, they do not readily attack any warm-blooded animal, and indeed the structure of their mouth is ill adapted for such a purpose ; but they feed greedily upon carrion, and thus assist in clearing the surface of the earth of noxious substances, as well as in destroying vast numbers of those insects which are most eminently injurious to vegetation. Hence they are of considerable service to man ; and as they in general remain perfectly quiet under the hedges, and in other hiding-places, and never do the slightest injury to anything which is of value to the human race, they are productive of good, and not evil, in cultivated countries. Perfectly harmless as they are, however, various charges of wrong-doing have been brought against them. Thus, for instance, some have alleged that they climb fruit-trees, and plunder the fruit by pricking it on their spines ; while others allege, with equal confidence, that they suck the cows, and wound the udders of these animals in a painful manner. We need hardly add that these allegations are not, and cannot be, true ; but they are believed in some parts of the country, and therefore they deserve notice, as belonging to that class of absurd prejudices against animals which cannot too soon be exploded and forgotten.

There is no doubt that the singular form and covering of hedgehogs has been the cause of those charges against them, just as the singular form of the bill of the goat-suckers led to a charge against them of plundering the udders of cattle ; whereas the bill of a goat-sucker is so utterly unfit for such a purpose, that, if we were to fix upon a mouth that could not suck in any way, the very best one to choose would be that of the goat-sucker.

But it generally happens that, while the singular appearance of an animal caused one class of superstitious dreamers to arm it with impossible powers of mischief, another class of the same description of personages was sure to endow it with virtues to which it had as little claim. Pliny, the most laborious compiler of natural history, if not the most correct naturalist among the Romans, gravely asserted that an ointment compounded of the gall of the hedgehog, and the brains of the bat, was the most effective application in the world for removing hairs from any part of the human body where their presence was not wanting ; and thus it appears, that in the matter of personal beauty, the Romans were just as great fools, and, by necessary consequence, as much exposed to the knaveries of quacks, as the

patchers and menders of personal appearance are at the present day. This, however, is by no means the climax of credulity with regard to the wonderful powers of the hedgehog ; for the learned Albertus Magnus, who was not only one of the brightest stars of his age, but had the light of a good deal of true knowledge about him, gravely asserts that an application for the eyes is attainable from this animal superior to all the "Euphrasy and rue" which poets ever sung, or dreamed, or fancied. He says, that if the right eye of a hedgehog is taken, and fried in oil, and applied to the eyes according to the rules of art, and when the stars are in favourable aspect and humour, it will so "purge the visual nerve," that the parties will thence see just as well during the blackest night as during the brightest day. Whether old Albertus, who was on some occasions a wag, as may be seen on perusing his work *De Secretibus*, meant this in irony, is not easy to say ; but it is certain that no application to the human eyes could make diurnal and nocturnal vision alike, except by rendering the former as dark as the latter.

There are only two known species of hedgehog ; the common one, which is found under hedges and in corn-fields in the richer parts of this country, and of Europe generally ; and the long-eared hedgehog, which we believe is chiefly found in northern Asia ; but, though they differ considerably in their appearance and structure, their habits are very much the same. The hedgehog of Europe has twenty-one vertebræ between the last cervical and the sacrum, and fourteen ribs on each side, with the rudiment of a fifteenth one. The long-eared hedgehog, on the other hand, has only nineteen vertebræ between the last cervical and the sacrum, and thirteen ribs on each side, with the rudiment of a fourteenth. Thus there are seven lumbar vertebræ in the common hedgehog, while there are only six in the long-eared one. The angular projection of the lower jaw is longer and straighter in the long-eared one ; the bone of the nose is also longer, and the whole anterior part of the head is more produced. In both animals the vertebræ of the tail, though thirteen in number, are so exceedingly short, that the tail does not appear beyond the buttocks. There seems, indeed, a truncation in the posterior part of these animals which we do not meet with to so great an extent in almost any other. In animals which have the tail developed, and capable of much motion, the spinal marrow extends into that organ ; and active animals, whether they have much power in the tail or not, have the spinal marrow continued as far as the sacrum. But in the hedgehogs the spinal marrow is not continued beyond the seventh dorsal vertebra, so that four of the dorsal and lumbar, and the three sacral vertebræ, merely carry some nervous fasciculi. It is curious that the same deficiency in the posterior part has been found in the toad among reptiles, and in the tetrodon among fishes, both of which animals are deficient of power in the hinder parts of their bodies. Upon the ninth vertebra there is placed a large muscular disc, consisting of concentric fibres, and extending a considerable way over the surface of the animal, and the contraction of those muscular rings brings the body into the form of a ball, and also erect, so that they bristle out in every direction those spines which, when the animal is walking, are more or less directed backwards. Both species of hedgehogs get exceedingly fat toward the winter, which season they pass in a dormant

state. A large portion of this fat collects immediately over, and no doubt protects from the severity of the weather, that muscular disc to which we have alluded as being the organ by means of which the animal rolls itself into a ball. This is a very wise provision of nature, because this circular disc is really the most important muscle in the whole body of the animal. A hedgehog cannot defend itself against even a feeble enemy by active means, neither can it escape by running; and, therefore, its only defence is to present its bristling armour to the enemy; and unless it is put in water, it can remain with its body contracted for a considerable length of time.

Hedgehogs have been represented as inhabiting other parts of the world besides Europe and Asia, as, for instance, an American species has often been alluded to; but, as there are many rodent animals which have their hair or fur intermixed with spines, the probability is, that some of these may have been mistaken for true hedgehogs, for we believe there is no well authenticated instance of any one being found out of the localities to which we have alluded. We shall now very briefly notice the species.

THE COMMON HEDGEHOG (*E. Europæus*). The common hedgehog is about ten inches in length exclusively of the tail, which is not an inch long, and wholly concealed by spines. It is common in most of the temperate parts of Europe and Asia, and found also in some parts of Africa; at least such is stated, but it is, at all events, not numerous in that country. The nose is dusky black, scattered over with a few hairs, and shaped like the nose of a hog, and, like that, adapted for "rooting" or turning up the ground. All the upper parts of the body and the sides are closely covered with strong spines of about an inch in length, very sharp at the points, having the lower part white, the middle black, and the tips white. They are nocturnal, and reside chiefly in woods, fields, and gardens, affecting the roots and decayed trunks of trees, fissures of rocks, and heaps of stones and rubbish that have been gathered in meadows. During the cold season they retire into holes for hibernating, where they wrap themselves up in leaves and moss, and, consequently, dispensing with those stores of provisions which it has been erroneously alleged they lay up for themselves. They are never observed to drink, and they are capable of enduring protracted hunger, even in their most active moments. The hedgehog is mild in its manners, inoffensive and timid; and the more that it is threatened with molestation or danger, the more closely it shelters itself under its coat of prickles. Such is the contractile power of muscle with which it is endowed, that one will sooner be able to tear than uncoil it, unless by plunging it into water, when it swims with considerable ease. Though this little harmless creature is not insensible to pain, it has been known to undergo the cruel process of vivisection without a single groan. It is said that foxes contrive to coax the hedgehogs out of the defence of their armour, in order to devour them; but we are not aware that any one ever saw this put in practice; and therefore, the probability is, that it belongs to that class of gratuitous instances of cunning which have been so copiously ascribed to the fox. The boldest of the dogs, even the bull-dog, which will attack the most powerful enemy, and persevere to the death, can make very little of the hedgehog. There have been instances in which dogs of this species have laid hold of the animals and

shaken them till the muscles relaxed, and the covering was contracted on the back; but no sooner did this take place, and it happened only when the dog had thrown the animal so that it alighted on the ground, than the protecting armour was again contracted; and the dog, in attempting to seize the animal a second time, had his mouth so much lacerated with the spines as to be covered with blood, and he was ultimately forced to give up attempting to bite the hedgehog, and confine his attack to barking at it, which is not an uncommon habit with dogs, and they appear thereby to attempt frightening that which they cannot conquer. It is, in all probability, upon this principle that dogs which are cowardly in fight are always the most given to barking.

During the day, hedgehogs never move about, unless compelled by some accident; at this time they rest in holes of the earth, at the roots of bushes, under leaves, or in grass or other tall herbage, which affords them protection; and while thus reposing they are always rolled up. In consequence of this habitual retirement and repose during the day, they are less frequent to be seen in proportion to their numbers than perhaps any other animals; and therefore, even to the country people, in those districts where they are most abundant, a hedgehog is so seldom seen, that when the rustics get hold of one they hardly know what to do with it. A case occurred recently in one of the southern counties of England, which shows upon how slender grounds the name of being learned may be acquired among such people; and also how readily a mere name, which really has no meaning whatever, is sometimes accepted as a substitute for knowledge. Some rustics engaged at haymaking or harvest work, it matters not which, found a hedgehog snugly rolled up in its spheroidal form, and so bristled over with spines that even their hard hands could not touch it with impunity. What it was they were utterly at a loss to determine; but at length one old woman mentioned that her Joe had been three weeks at a Sunday school, was "larned" in consequence, and she was sure he could help them in their perplexity. The rustic scholar was sent for, and surveyed the hedgehog with as widely wondering eyes and mouth as it had been surveyed by any of the others and while he did this the group waited as wistfully for his response as the ancients did for those of the Delphic oracle. Having finished his survey, he declared, in the most solemn manner, "I'm sarten it's a *summat*." "There now," said the exulting mother, "didn't I know as Joe wart gy'un a *neame*." The name was perfectly satisfactory to the audience; and the simple youth was at once elevated to the rank of village philosopher; and it is not improbable that in more pretending classes, philosophic honours have sometimes been acquired on grounds not substantially differing very much from those above stated; and therefore the naming of the hedgehog contains a good moral, if we only knew how to bring it out.

The whole covering of the hedgehog does not consist of spines, for under them there is a close and curly fur; and it seems as though the insect world took vengeance upon an animal which destroys so many of their race, for the fur of the hedgehog is very much infested with ticks, which are as large as those that inhabit the fur of the dog; and the animal appears to have no means of getting rid of them but by taking to the water, in which it can swim with considerable ease. The muzzle, the borders of the

lips, the eyes, and the under sides of the feet are, however, always naked; and so is the tail and the mammæ of the female, of which there are five pairs. In the eyes there is a third eyelid, which can be produced so as to cover the eye, as in the cat. The eye and optic nerve are both very small, and therefore we may conclude that the sight of these animals is very weak. Hedgehogs which have been kept in a state of confinement (for they are very easily tamed, and when so, remarkably gentle) have given abundant proofs of this, by showing little excitement when objects of sight approach them. Their scent appears, on the other hand, to be very acute, for they keep constantly turning up their noses, moving the cartilaginous appendage, and apparently snuffing the wind in the same manner as pigs do. They swim much faster than they walk on the ground. Some tame ones have been brought to subsist wholly on milk and vegetable matter; but it is probable that, in a state of nature, they are very carnivorous. Some have alleged that they occasionally kill rabbits for the purpose of eating them, but, though a rabbit is more easily killed than almost any animal, this is somewhat doubtful. It is certain, however, that they eat very greedily the carrion of rabbits, hares, dogs, and other animals; and it is said that they contrive to break open the skull and eat the brain of the animal before they touch the flesh; and this is physiologically considered as being the most carnivorous trait in the character of any animal whatever.

They bring forth about the end of spring, and the young vary from three to seven. They are white at their birth, and the points of the spines are rarely perceptible through the cuticle. Hedgehogs are frequently introduced into houses for the purpose of expelling the *blattæ*, or cockroaches, which they pursue and devour with great eagerness. The Calmuc Tartars keep them in their huts in place of cats. Some years ago, a man exhibited in the Champs Elysées, at Paris, a large boxful of hedgehogs, which not only unrolled themselves, but allowed themselves to be handled and teased at his orders. There are other instances recorded of individuals of this species having been completely domesticated. The skin of the hedgehog was used by the ancients as a clothes-brush; and it is applied in some countries to the muzzle of calves which are to be weaned. Though the flesh of this animal is generally despised as food, the Spaniards are said to value it very much in Lent.

The hedgehog, considered altogether, is one of the most singular animals found in European countries. It is met with only in climates which are comparatively temperate, not occurring in high latitudes or at a great elevation upon the mountains; and even in those rich parts which constitute its proper localities, it retires under ground in the winter. Its temperature is indeed low, and its circulation sluggish at all seasons of the year, and it seems equally incapable of bearing extremes of heat, light, and cold, without passing into a dormant state. Though it is generally stated to extend into Asia, and even into the north of Africa, those statements are at best doubtful; and it is probable that the spiny animals of insectivorous habits which are found there are different species, or at all events different varieties, from our hedgehogs.

THE LONG-EARED HEDGEHOG (*E. auritus*). This species, in all its localities, is smaller than the European hedgehog; and it is at once distinguished from that by longitudinal furrows in the spines, which are

channelled longitudinally, and have the margins of the channels marked with little knots or tubercles. These spines are not either so long or so formidable as those of the European hedgehog; and therefore they form a much less complete defence to the animal. They are further distinguished by the shortness of their upper incisive teeth, and the length of their lower ones; by a tuft of long soft hair at the angle of the gape; and, above all, the greater length of their ears, from which they receive their names. The upper part of the body is covered with slender brown spines, with a whitish ring at their base, and a yellowish one at the point. They are not joined in tufts or shafts at their extremity to the root, but separated singly, and are smoothed back when the animal is in a state of repose. The nostrils are denticulated like the crest of a cock. The limbs are longer and more slender than those of our European hedgehog. The tail is conical shaped, almost naked, and rather shorter than the common species, and the hair is in general much finer; in the limbs and belly it forms a fine whitish hair; the muzzle is furnished with four rows of whiskers; the tail is of a yellowish white colour; the iris of the eye bluish. The female has usually two litters in the year, and brings forth from six to seven at a birth. It hibernates in holes a few inches below the surface of the ground. It feeds on insects, and can eat with impunity cantharides, and others which are so acrid and poisonous in their nature as that they blister the skin of the human body, and are attended with very serious effects if administered inwardly, unless in the most minute doses imaginable; and they also occasion the greatest uneasiness and pain to digitigrade mammalia, if these happen to swallow them. This is a singular distinction between the stomachs of at least some of the insectivorous carnassiers and of those which are more decidedly carnivorous. It has been said that bears can take with impunity doses of prussic acid which would be sufficient to kill a whole den of lions; and it is certain that even if one of those poisonous beetles upon which the hedgehogs feed habitually were to be swallowed by a strong dog, it would throw him into convulsions. This is perhaps one of the most wonderful instances which we have of the adaptation of animals to the nature of their food; and it is not wholly confined to the insectivorous and other plantigrade carnassiers, but is found to a certain extent in hogs, and may exist also in other pachydermata. Even among ruminant animals there are remarkable differences in this respect, for goats can eat plants which would produce the rot in sheep, and be of the most serious injury to oxen. This, however, is a department of animal physiology which is very obscure in itself, and has been very little studied; but it is at the same time one well deserving the attention of physiologists. In the case of the hedgehog, the powers of the stomach are as well adapted as its teeth for insect food, and for such insects even as are destructive to others differently adapted; if it were otherwise, its mental impulse and its physical capacities would frequently induce its destruction. This species closely resembles the European one in all its manners and habits; and towards the close of autumn it gets remarkably fat.

It is probable that those who have described the common hedgehog as being found out of Europe have confounded it with this species. On the other hand, it does not appear that this one has ever occurred in Europe, or in Africa, except in those parts which are

nearest to Asia. Hedgehogs, from their structure and the slowness of their motions, are not at all adapted for migration; and therefore we may not only expect that every species will keep closely to its locality, but that they must be considerably affected by the average character of the ear in that locality. In southern Africa, in Australia, and in the American continent, there are certainly none, for the spiny mammalia there belong either to the rodentia or the edentata. Hence the pendent-eared hedgehog of the East, the earless hedgehog of America, and some other varieties which have been founded upon mutilated specimens, cannot be received into this genus. The one of the Eastern Islands and that of America are rodent animals, approaching to the porcupines in some of their characters; and though some of the others feed on insects, none of them are carnassiers in the structure of the teeth.

HEDGE HYSSOP. Is the *Gratiola officinalis* of Linnæus, a medicinal plant belonging to the natural order *Scrophularinæ*, an herb indigenous to Europe.

HEDYCHIUM (Konig). A beautiful genus of East Indian plants, belonging to the first class and order of Linnæus, and to the natural order *Scitamineæ*. Generic character: calyx tubular; corolla of one petal, tubular; limb in six parts, turned back, middle lobe cut; stamens, filaments filiform and jointed; anthers terminal; style filiform; stigma funnel-shaped; capsule aggregate. This is a favourite genus of stove plants, requiring large pots, and a lofty house to flower in. They are increased by dividing the roots.

HEDYOTIS (Willdenow), or Indian madder, is a genus of annual and perennial plants, natives of India and other places. The *H. diffusa* was called *Oldenlandia diffusa* by Roxburgh; and Fischer found one in Russia, which he called *Oldenlandia ramosissima*. They belong to *Rubiaceæ*.

HEDYSARUM (Linnæus). A very extensive genus of annual, biennial, and perennial herbs, chiefly natives of Europe. The flowers are diadelphous, and consequently belong to the natural order *Leguminosæ*. This genus was formerly much more extensive than it now is, several new genera being taken from it. It comprises some highly ornamental, and a few elegant plants, admitted into the flower-garden, where they are easily increased.

HEISTERIA (Linnæus), is the *Bois Perdrix* or *H. coccinea* of Jacquin: a large West India tree belonging to the *Olacinææ*.

HELENIUM (Linnæus), a North American genus of annual and perennial herbs, belonging to *Compositæ*. They are tall growing plants, and are usually introduced among shrubs at some distance from the walk. They are increased by division.

HELIANTHEMUM (Tournefort), a very numerous genus of herbaceous undershrubs, and shrubby or creeping plants, chiefly European. They belong to the *Cistineæ*, and are cultivated as ornamental plants. The American species require the protection of a greenhouse or frame during winter: the European ones grow on rock-work or on the common borders.

HELIANTHUS (Linnæus). Annual and perennial herbs, originally discovered in America. The sunflower is in everybody's garden, and, from its large flaming yellow flowers, is universally known. It has often been affirmed, though there is rather more of poetry than truth in the assertion, that this plant is so completely identified with the luminary from whence it derives its name, that it regularly and

progressively follows its course. It is true that the "golden rayed flower" does, to a certain extent, revolve on its stem, but it is a popular error to suppose that it keeps a measured pace with the sun. The *H. tuberosus* is a culinary vegetable, cultivated in every garden, and plentiful in our markets. The Italians call this plant *Girasole articiocco*, of which our vulgar name "Jerusalem artichoke" is a vile corruption. The seeds of the common one, *H. annuus*, are very nutritious food for poultry; and in North America they are made into cakes by the Indians, and from them an excellent oil is extracted. The pith of the sunflower consists of pure medullion.

HELICARION (De Ferussac). A genus of shells, now united with that of *Helicolimax*, from which it differs so slightly as not to require a separation.

HELICELLA (Lamarck). A genus now united to that of *Helix*, of which it forms a species.

HELICHRYSUM (Persoon). A splendid genus of ornamental undershrubs, chiefly natives of Africa. Class and order *Syngenesia superflua*, and natural order *Compositæ*. Generic character: anthodium scaled, the inner scales are furrowed and rayed; receptacle naked. This genus was formerly included among the *Gnaphaliums*, but separated therefrom by Mr. D. Don and others. They are handsome greenhouse plants, thrive well in moor-earth mixed with loam, and cuttings placed in the same soil take root readily. Some of the species ripen seed.

HELICINA (Lamarck). The general structure of these molluscs greatly resembles that of the genus *Nirita*; but they are terrestrial, some feeding on trees and others on the surface of the earth: from the helix they may easily be distinguished by the transverse callous columella, depressed and diminished in thickness at the lower part; the shell sub-globular, not umbilicated; opening semi-elliptical and entire, with a sharp edge, forming an angle at the lower part of the side, with a horny operculum. The *Trochus vistarius* of Linnæus might easily be confounded with this genus; but its being a marine shell, and the callosity covering the whole of its lower surface, by which it is rendered convex, sufficiently distinguish it from the *Helicina*.

HELICONIA (Linnæus). A genus of large leaved herbs, natives of South America. Class and order *Pentandria Monogynia*, and natural order *Musaceæ*. Generic character: flowers included in coloured spathas; partial flowers in bundles; corolla six-cleft; the exterior clefts two-lipped and revolute; the inner convolute; stamens inserted into the base of the corolla; ordinary number six, but part of them often abortive; filaments awl-shaped and erect; anthers linear; style three-sided; stigma obtuse; capsule oblong, three-sided, three-celled, and full of seeds. The heliconias are stove plants, and require rich soil, ample space, and a strong heat to flower them in perfection.

HELECTRES (Linnæus). This is the Screw Tree of the East and West Indies. Class and order *Monodelphia Dodecandria*, and natural order *Bombaceæ*. These plants grow and flower freely in our stoves, and are propagated by cuttings.

HELIOCANTHARUS (MacLeay). A genus of coleopterous insects, belonging to the subsection of *Lamellicornes*, and having for its types the sacred beetles of the Egyptians (*Ateuchus Ægyptiorum*, Latreille, *Scarabæus Sacer*, Linnæus, &c.), having the front of the head divided by notches

into rays, the lateral margins of the elytra entire, the anterior tarsi obsolete, and the four posterior legs long and ciliated, &c. These insects are nearly allied, both in structure and habits, to the genus *Gymnopleurus* (which see), depositing their eggs in balls of dung, which they roll into holes prepared for their reception under ground. Mr. MacLeay has described fifteen species of this group in the *Horæ Entomologicæ*.

Perhaps there are no insects which have attracted so much celebrity as those now under consideration, and which were, amongst the many objects "qualia demens Ægyptus coluit," under the name of the beetles of the sun. Amongst the Egyptians, and other nations in friendly intercourse with them, these insects were objects of especial regard; and when we remember the singular character of the Egyptian speculations, and the great interest which attaches to the hieroglyphical discoveries of the present day, we are induced to inquire into the causes which could have led this celebrated people to attach so much importance to a comparatively insignificant creature like the heliocantharus.

Apollonius, in his work upon the symbolical wisdom of the ancients, has entered largely into this subject, describing three species of scarabæus; the first or the real scarabæus, or beetle of the sun presented several rays from the head, whence it was consecrated to the deity of the sun; and it was supposed that all the individuals of this beetle were of the male sex, and when one of them felt an inclination to continue its species, it sought out the dung of a cow, of which it composed a ball representing the globe. This ball it propels backwards with its hind legs, the insect looking at the same time in the opposite direction; and hence they come to be regarded as emblems of the sun, which appears to proceed through the heavens in a course contrary to that of the signs of the zodiac; and as these scarabæi were supposed to roll their balls in the direction towards the west, their own motion or at least their heads being directed towards the east, it was further supposed that the first of these motions was a symbolical exhibition of the diurnal, the second of the annual, motion of the earth and planets. Moreover, these male scarabæi were supposed to roll their balls from sunrise to sunset every day, for twenty-eight successive days, after which they buried them in the earth, in which they were supposed to conceal themselves for twenty-eight days, being the duration of a lunar revolution, and during which time the race of the scarabæi was supposed to be animated. On the twenty-ninth day, which the insect knows to be that of the conjunction of the moon with the sun, and of the birth of the world, it opens its ball, from which a fresh race of scarabæi make their appearance, casting the fragments into the water. For these fanciful and erroneous reasons, the Egyptians, anxious to delineate a being engendered by itself—selected the scarabæus. The second species has two horns upon its head like those of a bull, and was consecrated to the moon, that goddess of whom the heavenly bull, according to the Egyptians, was a type. The third species had but a single horn, and was of a different form. This, as well as the sacred ibis, was supposed to be consecrated to Mercury. Apollonius also mentions that the figure of a blind scarabæus was emblematical of the death of a person who had perished from a fever occasioned by the excessive heat of the sun.

The first of these species is considered by Latreille in a valuable memoir upon the sacred insects of the Egyptians, to be that insect which he has described under the name of the *Ateuchus Ægyptiorum*, and



Ateuchus Ægyptiorum.

which, having a metallic greenish tint, and being of a larger size, is supposed by him to have attracted the attention of this people, rather than the other species, which are uniformly black. Moreover, the former is only found in Nubia and Ethiopia, which were the portions of the continent of Africa supposed to have been first inhabited by the Egyptians. On coming more northward, however, other species are found, which, occupying the station of the former, necessarily became objects of a similar veneration. Latreille, was only able to find figures of the former on the mummies opened in his presence. The second species mentioned by Apollonius appears to be a species of *Copris*, or *Typhæus*, resembling our common English bull comber (*Typhæus vulgaris*); and the third is probably a species of the former genus, allied to our *Copris lunaris*.

As objects of worship these insects were sculptured with great skill, but the figures which have been discovered exhibit so many varieties, so much disfigured by the caprice of the artist, that the determination of many of them must be very doubtful; still their effigies must certainly have had the effect of recalling to mind the systems of cosmogony and mythology established by this extraordinary race of men. Harbingers of spring, and the types of fecundity, announcing by their reproduction the renewing of nature; singular from their instinct and forms, and occupied unceasingly like Sisyphus of old in rolling their balls along, it is not surprising that these insects offered to the priests of Egypt an emblem of the works of Osiris or the Sun. And it was not sufficient for their superstition that they should be found in every temple, upon the bas reliefs and capitals of columns, and upon obelisks, they were engraved with other hieroglyphical figures upon different kinds of stone, and fashioned into medallions of carved cornelian, engraved upon split pearls, pierced in order to form necklaces, as well as for rings and seals. The image of this tutelar deity followed the Egyptians, and descended with them to the tomb, small models of the scarabæi being usually placed in the chests of their sarcophagi; and one of these, mentioned in Greaves' "Pyramidographia," was formed of a magnet, which, although three thousand years had elapsed since it was taken from the rock, its natural bed, still retained its magnetic virtue. Sometimes even the insects themselves were put in the coffin; and on some of the mummies lately opened in this country, small

models of the insects have been found close to the body, folded under many layers of bandages.

The most precious metals were often employed in the construction of these models, in the place of marble or granite, and oftentimes the gigantic views of the Egyptians induced them to carve colossal statues of them. One of such colossal figures cut out of black granite is to be seen in the saloon of the gallery of the Elgin marbles at the British Museum, and which is so large that the writer could scarcely sit comfortably astride upon its back. This statue is known amongst entomologists by the name of Bonelli's horse; and as the anecdote relates to two distinguished entomologists, and has not hitherto appeared in print, we may be excused for occupying the attention of our readers a moment with it. When the late celebrated Italian professor Bonelli was in England, he was shown the various contents of the British Museum, and on arriving at this statue, the equally celebrated naturalist who accompanied him, and who at that period presided over the zoological department of the establishment, joyously invited him to mount the sun-beetle, which, from his diminutive size, his friend thought he would not be able to accomplish. He, however, succeeded with difficulty, and since that time the statue has acquired the name mentioned above.

We may in a great measure account for the discovery of so many of the models of the sacred beetles in mummies and sarcophagi, by recollecting that the habits of the insect would forcibly exhibit the phenomena of resurrection; and it is to this idea that Mr. Moore alludes in that fanciful work, "The Egyptian," in which he describes an Egyptian chapel, the walls of which were ornamented with the various symbols, by which the mystic wisdom of the Egyptian loves to shadow out the history of the soul, including "the Theban beetle as he comes forth after the waters have passed away, and the first sunbeam falls upon his regenerated wings," adding the following note from M. Jomard, "On voit en Egypte après la retraite du Nil et la fécondation des terres, le limon couvert d'une multitude de Scarabées. Un pareil phénomène a dû sembler aux Egyptiens le plus propre à peindre une nouvelle existence." And in the writings of St. Ambrose, the Messiah is frequently compared to a scarabæus, without any notice of the cause for such a strange comparison, although it evidently has partly originated in the supposed resurrection of the insect from the mud left by the retiring Nile, and partly in a still more fanciful reason for the application of this emblem to Christ, quoted by Moore from St. Augustine: "Bonus ille scarabæus meus, non eâ tantum de causa quod unigenitus, quod ipsemet sui auctor mortalium speciem indiceret sed quod in hoc nostrâ fœce sese volutaverit et ex hac ipsa nasci voluerit."

Many others were the superstitions connected with these insects entertained by the Egyptians, which it would occupy far too much space to detail. It is far more pleasant and refreshing to look at nature as she really is; and in observing the proceedings of the *Heliocantharus*, we not only find a most interesting instance of that instinct which induces the female to secure a fit retreat for her progeny, but also perceive the great share which these insects, like the *Geotrupes*, take in the general economy of nature, in places where they abound, as in Egypt. A recent author thus describes the proceedings of one of the species, in the last number of the Entomological Magazine: "*Ateuchus variolosus* flies always in the middle and

heat of the day. It walks backwards with its pellets, in which it buries its eggs, and which are generally made of asses' dung. The pellet is about an inch and a half or two inches in diameter, and in rolling it they stand almost on their heads with their backs to it, guiding it with their hind feet, and occasionally mounting to the top when they find difficulty in urging it on, probably to destroy its equilibrium. Its wedge-shaped and dentated clypeus gives it strong mechanical powers in removing obstacles, and as I frequently found it buried under stones, in looking for *Carabi*, we may remark the wisdom of Providence in furnishing it with a lever to raise such heavy weights."

HELIOPSIS (Persoon). Annual and perennial herbs of America, nearly related to *Bupthalmum*, and belonging to the natural order *Compositæ*.

HELIOTROPIUM (Linnæus). Herbs and undershrubs, natives of the warmer parts of the world, and belonging to the natural order *Boraginæ*. The *Heliotropes* or *Turnsoles* have long been cultivated favourites, in consequence of the fragrance of some of the species. The *H. Peruvianum* is seen in almost every cottage.

HELIX (Linnæus, and modern naturalists). The common garden snail at once illustrates the characters of this genus, properly so called, though Linnæus, under that designation, had blended together, in the strangest disorder, land, marine, and fresh-water molluscs, so intermingled both with regard to the habitat and functions of the animal, and the form and character of the shell itself, that the naturalist sought in vain for those concurring testimonies and distinguishing generic types, by which alone his mind could be guided in the propriety of adopting one system of classification in preference to another. Lamarck first ventured to depart from the arrangement of Linnæus with respect to this genus, and at once separated from the *Helices* the genera *Auricula*, *Caracalla*, *Cyclostoma*, *Planorbis*, *Achatina*, *Anastoma*, *Bulinus*, *Janthina*, *Paludina*, *Pupa*, *Ampullaria*, *Lymnæa*, *Succinea*, *Sigaretus*, some of the *Naticæ* and others, each possessing consistent, natural, and well-marked generic distinctions, sufficiently important to authorise their separation from the incongruous mass in which they had been confounded. Shells of the genus *Helix*, as it is now constituted, are all of them terrestrial, and their families innumerable; all parts of the globe not actually covered with water affording nourishment to the immense variety of different species which every where abound in the hottest as well as the coldest climates.

Their number and beauty can only be equalled by some families of the insect tribes, in which a similar extent of species is observable. We have already, under the article **CONCHOLOGY**, endeavoured to bespeak some compassion towards this much persecuted but useful animal, and will, therefore, only repeat the unanswerable conclusion, that where great reproductive powers, or a strong tenacity of life, exist in any class of the Almighty's creatures, great ends are to be worked by their agency, however humble their powers may appear to that most self-sufficient of all animals—man: a conviction of this is forced upon him even by the snail, would he but once condescend to examine the good services it renders mankind, upon the broad principle of universal benefit, dismissing narrow-minded prejudice, selfish interest, and ignorant cruelty. He would then hail this little creature as a benefactor to society, and its presence

would no longer be the signal for its barbarous destruction. The genus *Helix*, as it now stands established according to the modern school of naturalists, comprehends such of the shells, so called by Linnæus, as present the following constant and similar generic characters in all their species, namely, their being orbicular, convex, or conoid, generally globular; aperture entire, of a greater width than length, very oblique, contiguous to the axes of the shell, having the margin of it disunited by the angle of the previous evolution or whorl; the lip constantly thickened or reflected inwards, a circumstance which never takes place in marine or fresh-water shells, whose general appearance, in other respects, might resemble that of the *Helix*. The summit is always rounded and smooth, never turriculated, as in some very similar molluscs; the substance of the shell is never pearly, though externally and internally highly polished.

The animal is so constantly under our convenient observation, that it need not be here minutely described; and it affords so much instruction in the formation of shells generally, that we earnestly invite the young naturalist to walk abroad and seek from a snail that practical information which volumes might fail to convey so clearly or so satisfactorily.

During the heat of the day these animals conceal themselves in moist shady places, and during winter they hibernate in the holes of trees and walls, and not unfrequently beneath the surface of the ground; some of them closing the aperture of their shell with a false or temporary operculum, protecting them from enemies and the change of temperature while they remain in that inactive or torpid state. Some instances have been pointed out already, in the article CONCHOLOGY, of the tenacity of this animal's life, and we need only add, that we believe it to be a well-attested fact, that a portion, or even the whole, of its head will be reproduced after having been severed from the body by accident or philosophical cruelty.

Being ourselves so much indebted to the snail for unravelling some of the apparently mysterious operations of nature in this branch of natural history, we cannot quit this article without trespassing a short time longer on the space allotted to our subject, a circumstance we have constant reason to regret, though it is our anxious wish to compress every useful information into the least possible compass. Should any doubt yet linger in the naturalist's mind of the propriety of adopting the system of modern malacology, founded as it is upon the organisation of the animals constructing and inhabiting a testaceous covering, in preference to that of former schools, in which the capricious shape of the shell solely guided the formation of their genera, let him examine the labours of the snail and judge for himself—he will there meet with such unanswerable evidence of the wisdom of deserting his old prejudices, that it would be palpably absurd still to adhere to them when another course is pointed out to him by Nature herself. In every case the study of nature would be greatly facilitated by observing more narrowly the indications she furnishes for a correct classification of distinct genera and species, which are but too frequently considered of little value, or altogether overlooked from being often but slightly defined; they are, nevertheless, of the utmost importance, and enable us to judge by analogy of that which we cannot in most cases confirm by actual observation, since the habits

of molluscs are so little known and so difficult to examine.

From the extremely numerous species of this genus, all naturalists have agreed upon the necessity of forming certain sub-divisions to facilitate a knowledge of the species. De Montfort pointed out several, Oken proposed others, and many other writers have done the same; but the Baron de Ferrussac has the most effectively occupied himself with this group of molluscs, and pointed out, to our thinking, the best and the most natural arrangement of the genus *Helix*. To his splendid publication, therefore, we must refer our readers for that minute detail we cannot here give at length, and will not be unjust enough to mutilate by abbreviation. Of the genus but few are known in a fossil state, and perhaps not more than three analogous to recent examples. A reference to the article FOSSIL will satisfactorily explain this fact, we will, therefore, conclude with observing that the genus *Helix* occupies a most important station in the economy of nature, and is well worth a much more serious contemplation than has hitherto been bestowed upon it, as it is one which will eventually conduce to beneficial results as yet but little known, particularly in this country, where snails are considered as common pests, and exterminated with inveterate diligence. The Linnæan genus *Helix* now forms the family *Limacina* of modern writers.

HELLEBORUS (Linnæus). A genus of European herbs, particularly well known for their imputed poisonous qualities. Class and order *Polyandria Polygynia*, and natural order *Ranunculaceæ*. Some of them are early flowerers; hence one is called the Christmas rose. The whole are accounted violent drastic purgatives, and in large doses dangerous. They are mostly now laid aside, and with reason, as when incautiously administered as anthelmintics death has ensued. The *H. orientalis* grows plentifully on Mount Athos at Delphi, and on the Bithynian Olympus.

HELLENIA (Willdenow). A genus of perennial herbs found in New Holland and China, belonging to the first class and order of Linnæus, and to the natural order *Scitamineæ*.

HELONIAS (Linnæus). North American herbaceous perennials, belonging to the sixth class of Linnæus, and natural order *Melanthaceæ*. These plants are hardy, and affect a peat soil and moist situation. They are increased by division or seeds.

HELOPHILUS (Meigen). A genus of dipterous insects, belonging to the section *Athericera* and family *Syrphidæ*, having the body rather long and nearly smooth, the hind thighs large, thickened, and finely toothed, the face impressed below the antennæ, and the wings not carried horizontally when at rest. These are large flies, nearly allied to *ERISTALIS* (which see), being however much fewer in number of species, the type being the *Musca pendula*, a name given to it in allusion to the habits of the larvæ, which resemble those of *Eristalis* both in structure and locality, as do also those of the perfect insect.

HELOPHORIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera* and subsection *Philhydrida* of MacLeay. This family comprises a few genera of minute aquatic beetles which seem to form the connecting link between the true water and land beetles, having clavate antennæ. In this point of view, therefore, the family possess

considerable interest. Unlike the former, the structure of the legs, and the want of ciliæ, or hairs, on the limbs, prevents them from swimming; so that it is rather by walking than swimming that they preserve their aquatic situation. The body is oblong and depressed; the antennæ composed of nine joints, clubbed at the tips; the mandibles are destitute of teeth; and the maxillary palpi very long, a character which they possess in common with the more typical water-beetles (*Hydrophilidæ*); they creep but slowly, and may often be observed in muddy water and at the roots of aquatic plants; sometimes also in fine weather they leave the water and take flight. The genera are *Helophorus*, *Hydrochus*, *Ochthebius*, and *Hydræna*, the first of which is distinguished by the moderate length of the maxillary palpi, which have the last joint thickened and oval, and by the transverse form of the thorax. There are eight English species, the *Silpha aquatica* of Linnæus being the type. It is about a quarter of an inch long, and of a dull brassy brown colour, with the elytra greyish. In *Hydrochus* the thorax is long and the eyes very prominent, whence the typical species is termed *Cicindeloides*, in allusion to its resemblance in these respects to the tiger beetles. In *Hydræna* the maxillary palpi are very long, being nearly half the length of the body.

HELOPIDÆ (Stephens; **HELOPII**, Latreille). A very extensive family of coleopterous insects, belonging to the section *Heteromera* and to the subsection *Stenelytra* of Latreille; having the antennæ inserted near the eyes, beneath the lateral margins of the head, nearly filiform, or but slightly thickened at the tips; the joints generally cylindric and slender at the base, the third joint being elongated; the tips of the mandibles have a notch; the maxillary palpi are terminated by a large hatchet-shaped joint; the eyes are oblong, and kidney-shaped; the tarsi generally simple, as well as the claws. These insects, which are generally elegantly marked and variegated in their colours, are for the most part inhabitants of tropical regions, where vegetation abounds, the perfect insects being chiefly found upon the trunks of old and decaying trees; the larvæ, of which very few have been observed, feed also upon the wood of such trees. They are filiform, smooth, and shining, with very short legs, resembling those of the meal-worm (*Tenebrio molitor*). Mr. Stephens introduces the *Cistelides* of Latreille into this family, which have the antennæ exposed at the base, the mandibles entire at the tips, and the tarsal claws toothed. In other respects they are closely allied to the true *Helopidæ*. There are numerous genera established in this family, chiefly founded upon exotic species, of whose habits nothing is known. The English genera are *Helops*, *Eryx*, *Mycetocharus*, *Cistela*, and *Allecula*, which, with the exception of the first, belong to the subdivision of the *Cistelides*. The genus *Helops* is remarkable for having the anterior tarsi of the males dilated. The thorax is transverse, and applied to the base of the elytra. There are four British species, of which the type is the *Helops caraboides*, an insect found abundantly throughout the kingdom at the roots and under the bark of trees and upon the broom. It is of an elongate ovate form, of a pitchy brown colour, and thickly punctured, the antennæ and tarsi being of a dusky red.

HEMEROBIIDÆ (**HEMEROBIDÆ**, Leach). A family of neuropterous insects belonging to the section *Planipennes* of Latreille, having the body slender and much shorter than the wings, which are large

and very much reticulated, resembling very fine network; the antennæ slender and filiform; the palpi only four in number, the terminal joint being thicker than the preceding; the first segment of the thorax is very small, and the wings, when shut, are deflexed; the body is soft; the eyes globular, and often splendidly metallic. They fly very slowly. These insects, which in their perfect state seem so delicate and harmless, are produced from grubs which are exceedingly ravenous, very much resembling those of the ant-lion (*Myrmeleonidæ*) not only in their appearance but also in their ravenous propensities. Like the grubs of the ladybirds, they subsist upon plant-lice, which they seize with their jaws, which are long and curved, and which they suck to death in a very short time. Some of these larvæ moreover invest themselves with the skins of their victims, which gives them an extraordinary appearance. When full grown the larva envelopes itself in a globular cocoon, composed of a very fine tissue of silk, and which in proportion to the size of either the larva or perfect fly is very small. The spinnerets of the larva are placed at the extremity of its body, as in those of the ant-lions. These larvæ are produced from eggs, deposited by the females in patches of ten or a dozen together upon the leaves or stems of various plants, of a white colour, and raised from the leaf upon a long glutinous footstalk of the same colour, finer than a hair. Hence by some authors they have been described as a remarkable species of fungi. From their habits they are thus essentially beneficial from the number of aphides they destroy; and it is a curious circumstance that, like the ladybirds, they should emit a strong and exceedingly disagreeable smell, which remains upon the hand for a considerable length of time. The genera belonging to this family are *Osmylus*, *Nymphes*, from New Holland, *Drepanopteryx*, *Chrysopa*, and *Hemerobius*.

In *Osmylus*, which comprises the largest British species, (*O. maculatus*, F.) the ocelli are three in number, and the antennæ moniliform. In *Chrysopa* (Leach) the ocelli are wanting, and the joints of the antennæ are cylindric. There are twelve British species, including the type *Hemerobius perla* (Linn.), or the golden-eye, a very elegant species, of a green colour, the wings clear, with green veins. It is a very common species. The *Hemerobii*, as restricted by Dr. Leach, are smaller species, having moniliform joints to the antennæ.

HEMEROCALLIDÆ. A natural order of plants comprising eighteen genera, and two hundred and sixty-one species already described. They are mostly fine showy plants, bearing their flowers in umbels or racemes, either white, yellow, red, or blue. They are mostly inhabitants of temperate climates, and are of little utility, with the exception of the aloe, the medical and economical uses of which need hardly be mentioned. Here we find some of the gayest ornaments of the stove, greenhouse, and flower-garden. The alettris, agapanthus, tritoma, &c. belong to this order, and many other equally interesting plants.

HEMEROCALLIS (Linnæus) is the day-lily, a common hardy flower-border plant belonging to *Hexandria*, and is so named from the fugacious character of its flowers. It gives a title to the natural order *Hemerocallidæ*.

HEMIPTERA. In the Linnæan system of zoology the name of the second order of insects, characterised by having the wing-covers of a consistence

intermediate between the scaly covering of the beetles and the membranous wings of the flies, being semicrustaceous, not meeting together when at rest by a straight suture, but having some portion of the inner margin of one wing-cover folded over the other. In the order thus characterised by the structure of the wings alone, were included the cock-roaches (genus *Blatta*), praying mantes (*G. Mantis*), and locusts and grasshoppers (*G. Gryllus*, Linnæus), having the mouth armed with jaws; and *Fulgora*, *Cicada*, *Notonecta*, *Nepa*, *Cimex*, *Aphis*, *Chermes*, *Coccus*, and *Thrips*, having (with the exception of the last, which has not yet been satisfactorily examined) the mouth suctorial, furnished with a proboscis. Hence De Geer, by a combination of structural characters, and Fabricius, following up his system, derived from the cibarian organs, separated the mandibulated genera from the others, to which the name of *Hemiptera* became restricted, the others acquiring the names of *Ulonata*, Fabr., or *Orthoptera*, Olivier. Latreille, however, adopting a system derived from general instead of isolated characters, separated the *Hemiptera* (which Fabricius termed *Rhyngota*) into two great sections, the first having the wing-covers horizontal and of unequal consistence, the basal portion being coriaceous, and the terminal half membranous, retaining for these the name of *Heteroptera*, and giving that of *Homoptera* to the second section, in which the wing-covers are deflexed and of equal consistence throughout. Moreover, in the first of these divisions the rostrum, or promuscis, as it is termed by Mr. Kirby, arises at the front of the underside of the head, whereas in the second it springs from its posterior portion, near the base of the fore-legs, and sometimes appearing pectoral. Dr. Leach, followed by Mr. Mac Leay and some other English authors, considered these two groups as possessing the rank of distinct orders, the first retaining the name of *Hemiptera*, and the second *Homoptera*. Kirby, also, and Latreille, from their agreement in possessing an articulated proboscis, have however regarded them as belonging only to one order. Mr. Kirby, however, gives the following observations as indicating the chief differences between them:—1st, “the heteropterous section usually sucks the juices of animals, and the homopterous those of plants,” but this is by no means correct: the majority of the former, as well as the latter, are plantisuges; (in the former the hemelytra, besides their different substance) as well as the wings, cross each other; while in the latter the organs of flight are deflexed and do not lap over each other at all. The antennæ, also, of the one are often long, and do not terminate in a bristle; whilst in the other, with few exceptions, they are very short and setigerous. In the *Heteroptera* the body is depressed and flat; in the *Homoptera* convex and thick. In the former the scutellum is one of the principal features of the trunk; in the latter not at all remarkable.

Regarding these points of distinction as of no small importance in the establishment of distinct orders, we find the order *Hemiptera* characterised by the *jointed, sucker-shaped mouth*, the *wings membranous*, covered by *wing-covers*, either *entirely membranous* and deflexed, or *partly coriaceous* and *partly membranous* and horizontal, and the *tarsi never composed of more than three joints*. The mouth is composed of a fleshy articulated canal, terminating in a point inclosing several fine bristles, which are employed as lancets in wounding the substances upon which the insects feed; it is also

furnished externally at the base with a small conical place transversely striated, which represents the upper lip of the other orders. When unemployed this proboscis is laid along the breast, often reaching to or even extending beyond the base of the hind legs; when employed it is protruded forwards.

All the insects belonging to this order undergo a series of moultings, analogous to those of other insects, although less in degree. They are produced from eggs as small active six-legged larvæ, having nearly the resemblance of the perfect insects, but entirely destitute of wings or wing-covers. After shedding the skin several times, gaining thereby only an increase of size, they appear as pupæ, but still active, and differing only from the larvæ by having the wings and wing-covers concealed in small cases placed upon the back. Another moulting brings them to the imago state, in which their wings are fully developed. In the apterous, or wingless species, the transformations merely consist in a gradual increase of size at the successive moultings. The pupæ of the *Hemiptera* take as much nourishment as the larvæ.

The majority of these insects are found in their various states upon plants, the juices of which serve for their nourishment; some few however inhabit the water (as the *Nepidæ* and *Notonectidæ*), whilst others reside upon its surface, as in *Gerris*, *Hydrometra*, &c. These appear to prey upon other dead or floating insects; others fly in the air with great agility, although they walk but slowly; and some leap to a great distance, as in the *Cecropidæ*. A few of the species, one only of which is found in our climate, attacks man, namely, the *Cimex lectularius*. The majority are varied in their colours; a few only (as the *Nepa grandis* and large exotic *Cicadæ*) attain a large size; the majority being less than an inch in length.

As above characterised, the order *Hemiptera* is divisible into two sub-orders, or primary classes, the *Heteroptera* and *Homoptera*, the distinctions of which we have already detailed in this article.

The sub-order *Heteroptera* (or the order *Hemiptera* of Leach, Mac Leay, Stephens, &c.) is divisible into two primary divisions, namely, the *Geocoris*, or land-bugs, and *Hydrocorisa*, or water-bugs.

For the characters of the *Geocoris*, see our article upon that group, and that upon *Cimex*, in which the various subsections or families are described. For the characters of the *Hydrocorisa*, see the article upon that group; and for an account of the other sub-order, and its divisions, see the article *HOMOPTERA*, and the various articles referred to from it.

HEMLOCK is the *Conium maculatum* of Linnæus, a common and dangerous British weed. It belongs to the natural order *Umbellifera*, and is nearly related to the genus *Smyrnum*. The death of Socrates has conferred such a celebrity on the hemlock, that more plants have contended for the honour of bearing death to the philosopher than cities for giving birth to Homer. The *Concion* of the ancients was a potent poison administered to those condemned to death by the Areopagus. Theramenes and Phocion, as well as Socrates, were poisoned by it; and although the effects recorded in history are not in correspondence with those we should look for from the common hemlock, it is highly probable that this was the poison employed. That the modern *Conium* is identical with the *Concion* of the Greeks, is rendered probable from its being very common in Peloponnesus, and “most abundant between Athens and Megara,” according to

Sibthorpe. The other plants which have been named as affording the *Concion*: viz., the *Cicuta virosa*, *Ænanthe phellandrium*, and *Æthusa cynapium*, are not found in any part of the country. The hemlock, however, is, like others mentioned, a poison to some animals, and innocuous to others. It is said to be fatal to kine, but that horses, goats, and sheep, may feed upon it without danger; and most brute animals can eat it when dry with impunity. Although, whether fresh or dry, it is poisonous to man, yet thrushes will eat the seeds, which are more potent than the leaves.

HEMLOCK SPRUCE FIR is the *Abies Canadensis* of the Hortus Kewensis. An American fir, so called from its branches in tenuity and position resembling the foliage of the common hemlock.

HEMP is the *Cannabis sativa* of Linnæus. An agricultural annual plant of large stature, and which affords the hemp of commerce. Of hemp there are two principal varieties, esteemed by some writers as distinct species: viz., the European hemp, with opposite leaves; and the Indian, called in the Peninsula, Bang, the leaves of which are alternate. In India, hemp is cultivated as a luxury, and used solely as an excitant. It possesses peculiar intoxicating powers, and produces luxurious dreams and trances. The leaves are sometimes chewed or smoked as tobacco. A stupifying liquor is also prepared; and they enter with opium, betel-nut, sugar, &c., into various narcotic preparations.

In Europe it is largely cultivated, but exclusively for its use in the arts. Its fibres are tough and strong, and peculiarly adapted for weaving into coarse fabrics, such as sail-cloth, and twisting into ropes and cables. Immense quantities are imported into this country for the use of the navy, and large stores kept; for it is not a profitable crop in a well-peopled country where corn is in great demand. The seeds abound in oil, which is relished by the Russians as food; in other countries it is chiefly used by painters, or to burn. The seeds are nutritious, and form a favourite food of cage-birds. But hemp-seed has the very singular property of changing the colour of the plumage of bullfinches and goldfinches from red and yellow to black, if they are fed on it for a long time, or in too large a quantity.

HEMP AGRIMONY is the *Eupatorium cannabinum* of Linnæus, a British plant, found in damp places. It belongs to the natural order *Compositæ*.

HENBANE is the *Hyoscyamus niger* of Linnæus, a British biennial herb, found in rubbish heaps, or on uncultivated ground. It belongs to *Solanææ*. Henbane is a powerful narcotic, and when taken in any considerable quantity proves quickly poisonous to men and most brute animals; swine are said to be able to eat it with impunity.

HEPATICA (Dilwin), a genus of beautiful little flowering plants belonging to the natural order *Ranunculaceæ*. The *H. triloba*, with its varieties of blue, red, white, and snow-white blossoms, are in every flower-garden, and appear among the earliest gems of the season. It was called *Anemone hepatica* by Linnæus.

HEPATICÆ, a natural order of the first class in the second grand division *Cellulares*, and comprises small creeping plants, with their leaves arranged in an imbricated manner. They differ from lichens in structure, colour, and fruit; from mosses in the dehiscence of their capsules. Their qualities are mild, if any, and some of them are fragrant.

HEPIALIDÆ (Stephens). A family of nocturnal lepidopterous insects or moths belonging to the subsection of which *Bombyx* is the type, and forming, with the *Bombycidæ* and two other families, the *Lepidoptera pomeridiana* of Stephens. The antennæ are very short and necklace-shaped, being simple or but slightly pectinated, although in one of the genera, *Zeuzera*, they are strongly pectinated at the base. The spiral tongue, which forms so conspicuous a feature in the lepidopterous character, is here obsolete, and even the palpi are sometimes represented only by a slight tuft of hairs. The wings are large, narrow, and deflexed, when at rest. The larvæ are large, naked fleshy caterpillars, which feed either on the roots of vegetables or burrow in the soft wood of various trees. They are furnished with sixteen legs, eight of which are abdominal and two anal. The chrysalis is cylindrical, having the abdominal segments strongly armed with small hooks, whereby, immediately previous to assuming the winged state, they are enabled to push themselves forward to the surface of the ground, or to the outside of the tree in which they had the instinct, whilst larvæ, to form a burrow. In their habits, therefore, these insects nearly approach to some of the aberrant *Crepuscularia* or *Ægeridæ*, the larvæ of which feed upon the pith of various trees, and, like them, they are occasionally obnoxious, destroying trees and other useful plants. The family comprises the three English genera *Hepialus*, *Cossus*, and *Zeuzera*.

In the first named genus the antennæ are much shorter than the thorax, and setaceous. The caterpillars live under ground, feeding upon the roots of plants. These moths, of which there are six British species, are termed Swifts by collectors, owing to their rapid flight; the females are generally much larger than the males, and differently coloured, although their markings are similar. One of the species, *Hepialus humuli*, is very common in grassy places during the month of June. The male is of a pure silvery white colour, but the female is of a yellowish buff with darker markings. The male is remarkable for its singular mode of flight, which resembles the motion of a pendulum; and as this is continued for a great length of time over one spot (where the female is probably stationed), and as the insect is often observed in country church-yards, the harmless insect has got the credit of being nothing less than the unquiet ghost of some person over whose grave it happens to be seen hovering, and has accordingly thence obtained the name of the ghost moth. This species varies in the expansion of the wings from one inch and three quarters to three inches.

The genus *Cossus* contains the large dingy coloured moth known by the name of the goat moth, from the strong scent emitted by its larva. See GOAT MOTH.

The genus *Zeuzera* contains but a single British species, the wood-leopard moth, *Z. Æsculi*, distinguished by having the basal half of the antennæ in the males strongly bipectinated, and in the females wholly, whilst the terminal half is quite naked. The caterpillar feeds upon the wood of the apple, pear, and other trees, but it is a rare species.

HERACLEUM (Linnæus), a genus of the largest herbs produced in Europe. In England it is called cow-parsnep, or kexes, and is very common in damp meadow ground, making the hay coarse, and of less value. To free a meadow of this plant it should be grazed with sheep till late in the spring. The sheep

eat off the head of the stem, and prevent it rising to seed. It is certainly the Hercules of British plants.

HERBERTIA (Sweet), a bulbous genus of plants from South America, named in honour of the Hon. and Rev. W. Herbert, an assiduous botanist. It belongs to *Irideæ*, and its species are cultivated with other bulbs in a frame, or warm border, only requiring to be defended from severe frost.

HERB PARIS is the *Paris quadrifolia* of Linnæus, a curious British plant belonging to the natural order *Asphodeleæ*, found in damp boggy places under trees.

HERB ROBERT is the *Geranium Robertianum* of Linnæus, a common British plant found under every hedge.

HERIADES (Spinola), a genus of bees nearly allied to *Chelostoma* (which see), but having the jaws triangular, and the maxillary palpi only two-jointed. They are of small size, and make their nests in old posts and trees. There are two British species.

HERITIERA (Hortus Kewensis), East Indian trees, called the "looking-glass plant." They belong to the natural order *Byttneriaceæ*, and thrive in our stoves, in loam and moor earth, and are propagated by cuttings.

HERMANNIA (Linnæus), a genus of ornamental shrubs from the Cape of Good Hope. Class and order *Monadelphina Pentandria*, and natural order *Byttneriaceæ*. They are easily managed greenhouse plants, growing in any light soil, and readily struck from cuttings.

HERMINIUM (R. Brown), a common British orchis, formerly called *Ophrys monorchis* by Linnæus. Found in damp meadows.

HERNANDIA (Linnæus), a genus of large East Indian trees, belonging to *Laurineæ*. The *H. sonora*, or Jack in a box, is so called from the noise made by the wind whistling through its persistent involucels. The juice of the leaves is found to be an advantageous and effectual depilatory, as it destroys the hair wherever it is applied, and this without pain.

HERNIARIA (Linnæus), or rupture wort, is a genus of creeping and half-shrubby plants, natives of Europe. The flowers are pentandrious, and belong to the natural order *Paronychieæ*. They are highly ornamental when planted on rock-work.

HERON (*Ardea*). An interesting order of birds, belonging to the culirostral division of stilt birds or waders, and usually considered as a family, including the various divisions of herons properly so called, and also the bitterns and the night herons. We have already given some notice of the bitterns in the article BITTERN, and we have mentioned the general relations of the family in the article ARDEA, so that we shall here require to notice only the leading species.

Hérons are usually subdivided into three sections—herons properly so called, which have the legs very long; crab-eating herons, which have them much shorter; and egrets, which have the long legs and neck, and slender body of the true herons, but which have often very beautiful produced feathers on the back, by the assistance of which they float very lightly in the air. They are all more or less migrant, and birds of high and powerful flight; but those which have the produced or supplemental feathers, which are understood to be seasonal in most of the species, are generally regarded as being more migratory in their habits than those which have not. Herons, in one or other of their species, are found in most countries of the world. In all places they frequent

the banks of ponds, lakes, and rivers, and some of them are occasionally met with on the shores of the sea. They are stately in their march, and the vast length of their legs, necks, and wings, makes them appear much larger birds than they are in reality, for their bodies are light; and the sportsman who sees a heron on the wing, and succeeds in bringing it down by a shot, is apt to be astonished at the small bird which has come to him, considering the large one that he observed in the sky.

As is the case with all wading birds, they project the feet backwards while they are on the wing, and they generally fly so high, especially on their long journeys, that they are above almost every bird from which they need to apprehend any danger. The falcon, indeed, is the only bird of prey which can rise to the full elevation of a heron; and even from this bird the heron escapes, by doubling the neck back upon the shoulders, as this lessens the weight of the fore part of the body, and consequently allows the hind part to droop till the axis points upward obliquely at the fore part; and it will be readily understood that, when birds fly, the line of course which they attempt to make is the line of the general axis of the body, though the real course made good deviates from this in proportion to the weight of the bird. Herons are very light birds in proportion to their powers of flight, and they get the sky more rapidly than birds of more powerful wing; and therefore, even in the days of falconry, when the heron was favourite sport with the jer or the peregrine, there was no use of flying a falcon at a heron on migratory flight. The times chosen were generally those in which the birds were passing between their feeding-places and those where they nestle, or, at all events, repose. Herons do not, like storks and cranes, rest themselves standing on the ground, at least for any length of time. Their favourite places are on the tops of trees, especially those which have the upper branches lateral, and form a sort of wicker platform. The birds stand upon these, and very generally the whole body is seen above the tops of the trees, in which situation the birds have a noble appearance.

The forward flight of herons is not rapid in proportion to the length of their wings, neither do they move these with so much velocity as many other birds, although they are stroke-fliers rather than gliders on the wing. Birds which glide usually take their gliding-motion after having worked their wings very rapidly for some time; and thus, loosely-made birds, with light bodies and very long wings, never glide, though they continue to keep the sky with very slow action. The peculiar style of the heron's flight is best seen when the bird is nearly on a level with the observer, and retreating, in which situation it will be seen that the body is not the centre of motion, but that there is a point in each wing upon which the body and the tips of the wings appear to swing alternately, the body sinking when the tips are raised, and rising when they are depressed; nor are there any birds which show this motion in so great perfection. Herons are very industrious and successful fishers, but their food is pretty miscellaneous. They eat the spawn of fishes, worms, shelled and naked mollusca, crustaceous animals, frogs, and the smaller mammalia which inhabit near the water. They have but one principal moult in the year, and the sexes do not differ greatly from each other in

appearance; but the young and the old are often so dissimilar, that there are not a few mistakes in many of the descriptions; and this renders it necessary to be cautious how any heron, which is but little known, is erected into a species, or even a variety, until it has been seen both in the young and the adult state. Herons, though most of them frequent obscure and lonely places, have yet a good deal of social feeling about them. Those which, from the nature of their pastures, are forced to migrate, usually migrate in large flocks; and in the breeding-grounds they are generally crowded together, and build their nests even closer than rooks.

THE COMMON HERON (*A. cinerea*). This is the species which is best known in the British islands, in various parts of which, both north and south, it is resident in very considerable numbers, though it was much more abundant in former times, when more of the country was covered with pools and marshes, and the heron was sought for as game. The length of the full-grown bird is nearly three feet and a half, and the stretch of the wings upwards of five feet; the weight is between three and four pounds; greyish-ash is the ground colour of the body, marked with lines of black on the neck, and the parts generally with a black bar on the breast; the occiput, in the mature birds, is furnished with a long pendant black crest, which appears to guide the head when the bird strikes rapidly at its prey, and there are also produced silky feathers on the scapulars; the young want the crest, and also the scapular appendages, and on this account they have sometimes been considered the females, and described as such. The colours are not constant, for individuals are sometimes met with which are nearly white, but which do not, in any other respect, differ from the grey ones.

The common heron, like the raven, is found in almost every part of the world. It (or an analogous bird) has been observed within the arctic circle nearly all round, in all the temperate parts of America, in the East and West Indies, in Egypt, and along the banks of most of the African rivers. Indeed, there is scarcely any humid district on the whole surface of the globe in which this bird has not been found; and it is not unknown in the isles of the Pacific Ocean. Its favourite haunts are always countries covered with tall forests, in the neighbourhood of running or of stagnant waters, as the waters of such places are known to abound most with fish, in consequence of the rich supply of insect and other food upon which fishes subsist. It is capable of subsisting a very considerable time without feeding, though it often exposes itself to the severest weather while waiting for its prey. It is a most ravenous feeder when prey is to be had in plenty, and its digestive powers are equal. No bird is so formidable to the fishes of ponds, lakes, and small rivers, as the heron. In fresh water it will strike at, and wound, with its powerful bill, fishes which it is unable to lift out of the water; but it prefers smaller ones, which it can swallow readily either standing or on the wing. When it has advanced as far into the water as it can, without wetting its feathers, it awaits patiently the approach of its victims, into which it darts its bill with undeviating aim whenever they come in contact. Willoughby tells us that he saw a heron swallow no less than seventeen carp, which he estimated the bird could digest in six or seven hours, and then go to fish again.

It is vulgarly reported that the heron has a good deal of trouble when fishing for eels, because those slippery animals will not remain in the stomach, so that the bird may have to swallow the same eel a dozen times over. This is of course incorrect, for the stomach of a bird of far less digestive powers than a heron is a "bourne from which no living traveller can ever return," or escape by any self-exertion; and, besides this, we believe that, when the eels are of considerable size, so that they twist and wriggle about the bill of the heron, the bird always makes for the land, and finishes them by breaking the skull either with a dart of the bill or a stroke of the foot. That herons capture a vast number of eels is certain, and they carry them as favourite food for their young; but if an eel is swallowed as food for the swallower it appears no more. Though the heron usually takes his prey by wading into the water, he frequently also catches it on the wing; but this is only in shallow waters, into which he darts with more certainty than into the deeps, instantly pinning the fish to the bottom, and thus seizing it more securely. After having been seen, in this manner, with his long neck under water for a minute or so, he will rise on the wing with a trout or eel in his bill, and, after swallowing it entire either on the shore or in the air, will immediately return again to fish. Herons are frequently observed to feed by moonlight, when the fish come into the shallow waters. In fact, they are semi-nocturnal in their habits, and they prey on sea-fish as well as on those in the fresh waters. The different parts of their structure are admirably adapted to their mode of life, for they have long legs suitable for wading, a long neck to reach their prey, and a capacious gullet to swallow it. Their toes are long, and armed with long hooked talons, one of which is serrated on the edge, the better to retain the slippery spoil. The bill is likewise long and sharp, having serratures towards the point, which stand backwards, and act like the barbs of a fish-hook. Its broad and concave wings are of signal service in enabling it to convey its load of nourishment to the nest, and to transport its comparatively small and meagre body to distant regions. When we add to these circumstances the acute vision and patient vigilance of this bird, we shall see no reason for indulging in the gloomy strictures of Buffon, who would represent it as an instance of neglect and cruelty on the part of nature, as if the supremely wise and good Creator of all could ever destine animals to a life of wretchedness and misery. The heron has a very melancholy air, is exceedingly shy, and impatient of confinement. The young, to a certain extent, are capable of being tamed; but if the old ones are captured, they obstinately refuse all sustenance, and pine to death. In this state they have sometimes survived for a length of time. They fly very high in the air, especially before rain, frequently soaring beyond the reach of human vision. They are frequently inactive in the daytime, and indulge in repose, but seldom sleep during night, at which time they generally feed, and are very clamorous and noisy. Their cry is shrill and grating, shorter and more plaintive than that of the goose, but repeated and prolonged into a more piercing and discordant note when the bird feels uneasy or pain. They are often disquieted, from being suspicious, and naturally timid; and the appearance of a man, though at a distance, greatly alarms them; nor is it easy to

approach near them without raising them on the wing. They are particularly afraid of the more powerful hawks and of the swamp eagles, especially when they are fishing, and spy a bird of this kind above them; but, when driven to extremities, they fight with considerable resolution either on the ground or in the air; and, indeed, they can strike desperately with the bill, though winged or otherwise crippled. A place where herons breed, for the nests are scarcely ever single, is called a heronry. The nests are broad and shallow, formed of sticks, and lined with soft vegetable matters, or with wool, if the birds can procure it. They are very constant to their breeding-places; and Dr. Hcysham mentions an instance, in which a dislodged colony of herons took possession of part of a rookery, but not until after a desperate battle, in which many on both sides were killed. The eggs of the heron seldom exceed four, but they are sometimes as many as six. They are of a greenish-blue colour, and about the size of ducks' eggs. The female sits closely during the incubation, and is fed by the male; and, after the young are hatched, both birds join in the labour of feeding them, which, from their voracity and vigorous digestion, is no easy task.

THE GREAT HERON (*A. herodius*). This is an American species, resembling the common heron of Europe both in shape and in colour; but it is considerably larger in size, and almost double the weight. Its length from the point of the bill to the tail is four feet four; and the legs extend a foot beyond the tail. The extent of the wings is fully six feet; and the weight not less than seven pounds, while that of the common heron is generally less than four. It is highly probable, however, that when the common heron is mentioned as an inhabitant of North America, this is the bird alluded to; and though the size is larger, the bill longer, and the feet differently coloured, it is probable that the origin of the two may have been the same.

Abounding as it does in woods and waters, above all countries of the same extent which are met with on the surface of the earth, America is the very home of the herons. The species are very numerous, and the birds themselves abundant; and though the woods of America are remarkable for the multitudes of their birds, there is perhaps no race which are so characteristic as the herons. It would far exceed our limits to give any thing like a detailed account of the different species or of the peculiarities of the country; but we shall quote a passage from Wilson, in which the singular dwellings of the birds are portrayed with more graphic effect than has been done or could be done by any other writer, even though, like Wilson, a personal visitant. After mentioning that they are found in greater numbers on the Atlantic coast than in the central valleys, and pointing out some localities which are favourite ones with them, Wilson thus proceeds to describe their building-places. "These are generally in the gloomy solitudes of the tallest cedar swamps, where, if unmolested, they continue annually to breed for many years. These swamps are from half a mile to a mile in breadth, and sometimes five or six in length, and appear as if they occupied the former channel of some choked up river, stream, lake, or arm of the sea. The appearance they present to a stranger is singular. A front of tall and perfectly straight trunks, rising to the height of fifty or sixty feet without a limb, and crowded in every direction, their tops so closely woven together as to

shut out the day, spreading the gloom of a perpetual twilight below. On a nearer approach, they are found to rise out of the water, which, from the impregnation of the fallen leaves and roots of the cedars, is of the colour of brandy. Amidst this bottom of congregated springs, the ruins of the former forest lie piled in every state of confusion. The roots, prostrate logs, and, in many places, the waters, are covered with green mantling moss; while an undergrowth of laurel, fifteen or twenty feet high, intersects every opening so completely, as to render a passage through laborious and harassing beyond description; at every step, you either sink to the knees, elamber over fallen timber, squeeze yourself through between the stubborn laurels, or plunge to the middle in ponds made by the uprooting of large trees, and which the green moss concealed from observation. In calm weather, the silence of death reigns in these dreary regions; a few interrupted rays of light shoot across the gloom; and unless for the occasional hollow screams of the herons, and the melancholy chirping of one or two species of small birds, all is silence, solitude, and desolation. When a breeze rises, at first it sighs mournfully through the tops; but, as the gale increases, the tall mast-like cedars wave like fishing-poles, and, rubbing against each other, produce a variety of singular noises, that, with the help of a little imagination, resemble shrieks, groans, growling bears, wolves, and such like comfortable music. On the tops of the tallest of these cedars the herons construct their nests, ten or fifteen pair sometimes occupying a particular part of the swamp. The nests are large, formed of sticks, and lined with smaller twigs; each occupies the top of a single tree. The eggs are generally four in number, of an oblong pointed form, larger than those of a hen, and of a light greenish blue, without any spots. The young are produced about the middle of May, and remain on the trees until they are full as heavy as the old ones, being extremely fat before they are able to fly. They breed but once in the season. If disturbed in their breeding-place, the old birds fly occasionally over the spot, sometimes hoking like a goose, sometimes uttering a coarse hollow grunting noise, like that of a hog, but much louder. The great heron is said to be fat at the full moon, and lean at its decrease; this might be accounted for by the fact of their fishing regularly by moonlight through the greater part of the night, as well as during the day; but the observation is not universal, for at such times I have found some lean as well as others fat. The young birds are said to be excellent for the table, and even the old birds, when in good order, and properly cooked, are esteemed by many. The principal food of the great heron is fish, for which he watches with the most unwearied patience, and seizes them with surprising dexterity. At the edge of the river, pond, or sea-shore, he stands, fixed and motionless, sometimes for hours together. But his stroke is as quick as thought and as sure as fate, to the first luckless fish that approaches within his reach; these he sometimes beats to death, and always swallows head foremost, such being their uniform position in the stomach. He is also an excellent mouser, and is of great service to our meadows, in destroying the short-tailed or meadow mouse, so injurious to the banks. He also feeds eagerly upon grasshoppers, various winged insects, particularly dragon-flies, which he is very expert at striking; and also eats the seeds of that

species of nymphae called splatterdashes, so abundant along our fresh water ponds and rivers. The heron has great powers of wing, flying sometimes very high, and to a great distance; his neck doubled, his head drawn in, and his long legs stretched out behind him, like a tail, and probably serving the same rudder-like office. When he leaves the sea-coast, and traces, on wing, the courses of the creeks and rivers inland, he is said to prognosticate rain; when downwards, dry weather. He is most jealously watchful of man, so that those who wish to succeed in shooting the heron must approach him entirely unseen and by stratagem." "In our vast fens, meadows, and sea marshes, this stately bird roams at pleasure, feasting on the never-failing magazines of frogs, fish, seeds, and insects, with which they abound, and of which he probably considers himself as the sole lord and proprietor. I have several times seen the white-headed eagle attack and seize the great heron; but whether for sport, or to make him disgorge his fish, I am uncertain."

This is the characteristic heron of the Atlantic shores of the United States, not ranging so far to the north as the St. Lawrence, or very far into the interior. There are many smaller herons in America which are more discursive and migratory on the meridian; but the journeys of this one are chiefly from the sea to the base of the Alleghany mountains and back again.

GREAT WHITE HERON (*A. alba*). This species, though inferior in size to the former, appears very conspicuous from its colour. Some have alleged that it occurs, though exceedingly seldom, as a visitant in Britain; but the fact is not clearly established, neither is it well ascertained whence it would come in the event of its visiting our shores. It is found both in the eastern and in the western continent, or, at all events, there is but little difference between a bird which is known by the same appellation in each; and as the manners of the great grey heron of America are very similar to those of the common grey heron of Europe, so the manners of those birds which are referred to this species very much resemble each other.

The grey herons are resident birds rather than migrants, or, at all events, their excursions are between the shores and the inland in the same localities. The white herons, on the other hand, are emigrants, inhabiting climates farther to the south, where the seasonal alternations of wet and drought are much more marked. In the eastern continent they appear to belong chiefly to the central migration, or that which takes the line of the Caspian and the Black sea; while in America their range is between the valley of the Mississippi and the humid districts of the northern parts of South America. They are much more numerous in America than in the eastern continent, and distribute themselves as well along the coast as in the central valley. They arrive in the more southerly states early in the spring, proceed northward, and build in the cedar swamps nearly in the same manner as the great herons, which they also resemble in their general manners. The following are the characters of these birds: length from the tip of the bill to the tail three feet and a half; and extent of the wings about five feet. The feathers of the back extend, however, as much as seven or eight inches beyond the point of the tail. These feathers arise from the lower parts of the scapulars and sides of the back. The shafts are long

and tapering, and the webs consist of delicate filaments, very soft, and detached from each other. This plumage is peculiarly graceful and waving; and it hangs in an elegant curve over the hinder part of the body, completely concealing the tail. The plumes of this heron have at times been much prized in various parts of Europe, as graceful ornaments of the head; and the American Indians employ them for the same purpose. In the lower valley of the Mississippi they are obtained in such numbers that the Indians hawk them about in the streets of New Holland. These produced feathers have a delicate yellowish tinge, but all the rest of the plumage is of snowy whiteness. The bill is about half a foot long, of a bright orange colour, and black at the tip; the irides are pale orange, and the pupil very small; the legs are very long and stout, bare for four inches above the tarsal joint, and altogether of a black colour; the toes are long, the middle and hind one stretching nearly six inches from tip to tip; the middle claw is toothed on its inner edge, and the middle and exterior toes are united by membrane for about half an inch at the base. This structure of the foot is equally well adapted for walking on aquatic plants and on soft and muddy ground; and the length and strength of the legs, together with the extent to which they are naked of feathers, enable the bird to wade deeply without wetting its plumage. In the mature state, the male and female resemble each other very closely; and both have their produced feathers equally long. The young birds are different; and they do not acquire their perfect plumage till they are three years old, which indeed is the case with all the herons. The young birds have the common clothing feathers quite like the old ones; but they have not the produced feathers on the back: this circumstance has caused the old birds and the young to be sometimes described as different species, and at other times the ones without the produced feathers have been considered as the females; but this is not correct, for both sexes want these feathers while young, and both have them after arriving at maturity.

This species of heron is very widely distributed, being found as far to the south as India, where it is very abundant in the rainy season, though it disappears during the drought. The beauty of its plumage, and the high estimation in which the produced feathers have been held, have made it a bird of no little celebrity. It is the *Egret*, or great egret of common description, though we believe the proper meaning of that word is the ornament made of the feathers, and not those feathers as they exist on the bird.

LITTLE WHITE HERON (*A. garzetta*). This species is also very generally distributed, and is still more discursive than the larger one. It occurs most plentifully in latitudes and localities similar to those frequented by the other; but it ranges farther to the north, and also more extensively in longitude. It is the little egret of the East, and the snowy heron of America. The American one is indeed a little larger in size than the eastern one, and there are some slight differences in the colour of the naked skin; but those differences do not appear to be greater than they are in the grey heron of the two continents, and certainly they are not greater than might be expected to arise from difference of climate.

The grand difference between the American continent and the Eastern, is worthy of being attended to in deciding upon what is or is not the same species

of animal, as occurring in the two. In the central parts of the eastern continent, drought is the prevailing character of the climate; and in America, on the other hand, humidity predominates just as much. Now, in order to ascertain whether we ought to expect any animal to thrive better, that is, to attain a larger size and a more complete development, in the one continent or in the other, we must attend to the nature of the animal, so as to ascertain whether a dry climate or a humid one is the more congenial to it. If the former, we may presume that if the animal is native in America as well as in the eastern continent, it will be smaller and less perfectly developed in America; or if it is imported from the East to America, it will degenerate. We have a remarkable instance, in the case of animals of the same family, in the genus *Felis*, as existing in the two continents. There is no question that the whole of that genus are animals which prefer drought, and many of them cannot bear a wet climate. Hence we do not find in any part of America animals of such power and daring as the lions and tigers of the East.

But on the other hand, if the nature of the animal adapts it more to a humid climate, we may expect to find the same species more developed as native of America than as native of the East; or if imported from the East into America, we may expect it to improve. Here again we may take an illustration from the mammalia of the two continents. Bears, from their protecting coat of fat, and their strong and close hair, which completely thatches them against the weather, are remarkably well fitted for moist climates; and accordingly we meet with no land bears in the eastern continent at all equal in size, in boldness, or in strength, to those of America.

Now, if we apply this theory, which is very obviously true, to the case of herons, which are found only in marshy places, we can easily see that these birds possess such natural advantages in the American continent, as must lead us at once to conclude that the same species must attain a larger size and a more perfect development there. Food for herons, and also trees adapted for their nesting-places, are vastly more abundant in America than in the eastern continent, and therefore the birds have more enjoyment and less labour.

This is a point in the physiological geography of animals, which, so far as we are aware, has not been alluded to by any writer on the subject; but it is one of very great importance, not in helping us to explain some climatal modifications of animals, which otherwise would be a little perplexing, but as a warning against some very ridiculous prejudices which have been taken up by the romancers in natural history; and which, in consequence of the imposing style in which they are stated, have gained no small currency with the public. Taking up an exceedingly partial view of the case, namely, that of one or two animals, and not considering whether the climate of the east or that of the west suited best with the nature of those animals, these romancers of natural history have come at once to this sweeping conclusion, that "there is a tendency in nature to belittle all her productions on the west side of the Atlantic." It was somewhat natural that a sentence of condemnation so sweeping as this should occasion some wrath on the part of the American naturalists, though it does not appear that they got more into the philosophy of the case than their brethren of the east; and indeed, to

speak about any tendency which nature has, either to deteriorate or to improve her productions in one country more than another, is to utter words which have no meaning. That the whole system of nature, in all its parts, is equally perfect, is the fundamental truth; and though we cannot in all cases draw a clear line of distinction between that which determines a natural character, and that which possesses the character so determined, yet we may state it as perfectly general, that, according as any place is, so will be its productions; and the very beauty of the earth, and that which gives it its greatest value to man, as making the different nations in so far dependent upon each other, and thus pointing out to them the bonds of general peace and reciprocal assistance, is the diversity of climate and surface, and consequently of productions, in the several countries and their several districts. But, important as this point is, and necessary as it is that it should be strongly inculcated, as extending much farther than mere matters of natural history, we must leave it, and return to the little white heron.



Little Egret.

The length of this species is about two feet, and the extent of the wings between three and four; the weight rarely exceeds one pound. All the plumage is of the most brilliant white; the bird is furnished with a pendent crest, formed of a few long, straight, and waving feathers. There is a large tuft of similar feathers on the lower part of the neck, which are very straight and beautiful in their lustre. From the top of the back there proceed three ranges of feathers, about six or eight inches in length, with slender shafts, and the webs thin and light, and in detached filaments of a beautiful silky texture. The bill is black; the naked skin round the eyes greenish; the irides brilliant yellow; the upper parts of the tarsi, and the naked portion above the joint, greenish black; and the lower parts of the tarsi and the toes greenish yellow. The young want the produced feathers on the neck and the back. In the first year they are of a dull white, with the bill, the irides, and all the naked skin black. They build in marshy places, and the hatch consists of four or five white eggs.

Perhaps these are the most interesting birds of the

whole heron family. They are particularly handsome; and they are social and gentle in their manners, associating readily with other birds, and capable of being tamed without any great difficulty. Their plumes were once in high demand for adorning the helmets of the mailed warriors of the middle ages; and they are still used for decorating the head-dresses of ladies, and the turbans of persons of rank in the East.

In England these birds are now exceedingly rare, though one was found in South Devon in the early part of the present century. It was a female, supposed to be a young bird of the first year, but all pure white, with the exception of the crown of the head and the upper part of the neck in front, which were buff-coloured. Some idea may be formed of their abundance in times gone by, from the fact, that a thousand of them were served up at the grand feast given by Archbishop Neville, though at present it would puzzle all the bishops of England to collect a dozen in the whole country during a century. The following quotation from Wilson will enable those who take an interest in these very handsome birds, to compare the American one with the eastern, to which latter our observations have been chiefly applicable. "On the 19th of May," says he, "I visited an extensive breeding-place of the snowy heron, among the red cedars of Summer's Beach, on the coast of Cape May. The situation was very sequestered, bounded on the land side by a fresh water marsh or pond, and sheltered from the Atlantic by ranges of sand-hills. The cedars, though not high, were so closely crowded together as to render it difficult to penetrate through among them. Some trees contained three, others four nests, built wholly of sticks. Each had in it three eggs, of a pale greenish-blue colour, and measuring an inch and three quarters in length, by an inch and a quarter in thickness. Forty or fifty of these eggs were cooked, and found to be well-tasted; the white was of a bluish tint, and almost transparent, though boiled for a considerable time; the yolk very small in quantity. The birds rose in vast numbers, but without clamour, alighting on the tops of the trees around, and watching the result in silent anxiety. Among them were numbers of the night heron, and two or three purple-headed herons. Great quantities of egg-shells lay scattered under the trees, occasioned by the depredations of the crows, who were continually hovering about the place. On one of the nests I found the dead body of the bird itself, half-devoured by the hawks, crows, or gulls. She had probably perished in defence of her eggs. The snowy heron is seen at all times during summer among the salt marshes, watching and searching for food, or passing, sometimes in flocks, from one part of the bay to the other. They often make excursions up the rivers and inlets, but return regularly in the evening to the red cedars on the beach to roost. I found these birds on the Mississippi early in June, as far up as Fort Adams, roaming about among the creeks and inundated woods. The length of this species is two feet one inch: extent, three feet two inches! the bill is four inches and a quarter long, and grooved; the space from the nostril to the eye orange yellow, the rest of the bill black; irides vivid orange; the whole plumage is of a snowy whiteness; the head is largely crested with loose unwebbed feathers, nearly four inches in length; another tuft of the same nearly covers the breast; but the most distinguished ornament of this bird is a

bunch of long silky plumes, proceeding from the shoulders, covering the whole back, and extending beyond the tail; the shafts of these are six or seven inches long, extremely elastic, tapering to the extremities, and thinly set with long, slender, bending threads or fibres, easily agitated by the slightest motion of the air; these shafts curl upwards at the ends. When the bird is irritated, and erects these airy plumes, they have a very elegant appearance. The legs and naked part of the thighs are black; the feet, bright yellow; claws black, the middle one pectinated."

CRESTED PURPLE HERON (*A. purpurea*). This species appears to be wholly confined to the eastern continent, and to belong to the south-eastern migration. It is very common in the marshy places of Eastern Europe and Western Asia, in the north of Africa, and in the islands of the Mediterranean. It is not, however, mentioned as occurring even as a migrant in the peninsular part of India. In the west of Europe it is rare, and in the British islands it appears only as a very rare straggler. It is a marsh bird, building in tall reeds and other aquatic plants, and rarely perching on trees. The hatch consists of three eggs of a greenish ash colour, and without any gloss or lustre.



Crested Heron.

This is a very beautiful bird, and one of considerable size, the length, when full grown, being about three feet, and the stretch of the wings not less than four. The mature birds have a crest of long and slender feathers on the hind head, which are of a greenish black colour. At the lower part of the neck there are similar feathers of whitish purple; and the feathers on the scapulars and upper part of the back are also slender and produced, but they are bright purple. The top of the head is black, with bright green reflections; the throat white; the sides of the neck bright russet; there are three longitudinal stripes of black on the neck, one on each side from the eye downwards, and the third behind, but not extending to the lower part of the neck; the lower neck is mottled with longitudinal spots of russet, purple, and black; the back, the wings, and the tail are reddish ash, with purple reflections; the thighs

and abdomen russet, the flanks bright purple, and the breast the same; the bill and naked skin round the eyes are bright yellow; the irides orange yellow; the under parts of the toes, the rear of the tarsi, and the naked skin above the tarsal joints, yellow; and the scales on the fore parts of the tarsi and upper parts of the toes greenish brown.

The young have no crest on the hind head, although its place is indicated by the feathers being a little more produced, and they also want the long feathers on the neck and the scapulars; they have the forehead black, the nape and cheeks bright red, the throat white, the hind part of the lower neck yellowish white, with lines of black; the back, scapulars, wings, and tail, are blackish ash, bordered with bright russet, and the thighs and belly white; a considerable part of the upper mandible is blackish, but all the under one, and the naked skin round the eyes, bright yellow. In this state they have been described as a separate species, under the name of the African Heron. In its nesting-places this bird resembles the bitterns; but in its food, and manner of obtaining it, it is a true heron, differing little in these respects from the common grey heron.

THE SQUACCO HERON (*A. ralloides*). This species has the tarsi much shorter than the typical herons, and in this respect approaches to the bitterns, but, in many traits of its character, it has more resemblance to the herons, and, like them, it is said to nestle in trees. It is a very beautiful bird, and, though neither so striking or so showy in its plumage as the white herons, which have the produced feathers, it makes a very remarkable contrast with them. The feathers on the top of the head are yellow, margined with black; the crest, which consists of long and very narrow pendent feathers, has each feather white in the centre and black on the margin; the throat is white; the neck, the scapulars, and the upper part of the back, bright russet; and the produced feathers, which are very loose and flocculent in their webs, are rich maroon. All the rest of the plumage is pure white. The basal part of the bill is azure, and the tip black; the naked skin round the eyes greenish grey; the irides yellow; and the feet yellow, with a tinge of green; the garter, or naked space above the tarsal joint, is very short; the length is about seventeen inches.

The young, till the third year, want the produced feathers; they have the head, the neck, and the coverts of the wings, reddish brown, marked with dark oblong spots of the same; the throat, the rump, and the tail, are pure white; the quills ash-colour, with the inner webs white; the middle of the back and the scapulars pale brown; the upper mandible greenish brown, and the lower greenish yellow; the naked skin round the eyes green; the irides bright yellow; and the feet greenish ash. The nests are in trees, but the number and appearance of the eggs are not very well known.

From the shortness of the tarsi, and the unfeathered part of the tibiae above the joint, it may be inferred that these birds do not wade so far into the waters or fish so habitually as the more typical herons. They do catch fish, but their food consists fully as much of insects, shelled mollusca, and the smaller crustacea, and, on the last account, they have been styled "crab-eaters."

This species is very abundant in the countries around the Mediterranean, and in the marshy parts of Eastern Europe and Western Asia. It also comes

very frequently into Germany, Switzerland, and France, though only as a migrant. It is also more frequently seen in England than any of the other herons which belong to the south-eastern migration, but still it does not come so habitually, or in such numbers, as to rank as a regular visitant.

In many parts of the warmer countries there are short-legged herons which bear a considerable resemblance to this one, and which are also styled crab-eating herons. So little is known respecting them, however, especially with regard to their nesting and their plumage in the young and adult states; and in those parts of their history which are known, they bear so close a resemblance to this one, that nothing further could be added that would be of much interest to the general reader. There is, however, one other species, which is still smaller and more disjunctive than any of those already mentioned, and therefore it may be worth mentioning.

LITTLE HERON (*A. minuta*). This species is sometimes called the Danube heron, from its being frequently seen in the valley of that river, though we believe this name has been applied chiefly to the young, which, as in the rest of the genus, differs greatly from the mature bird in its plumage. The top of the head, the nape, the back, the secondary quills, and the tail, are of a rich black, with brilliant reflections of green; the sides of the head, the neck, the wing-coverts, and all the under parts of the body, are reddish yellow, and the principal quills are blackish ash; the bill is brown at the point, and yellow in the rest of its length; the naked skin round the eyes and the irides are yellow, and the feet yellowish green. The length of the bird is about fourteen inches, and the size nearly the same as that of a thrush.

The young of the first year have the bill brown and the feet green; the top of the head brown, and the back of the neck whitish, with numerous longitudinal brown streaks; the sides of the head, the nape, the breast, the back, and the wing-coverts, reddish brown, more or less dark, and mottled over with numerous longitudinal brown streaks. It is in this plumage that the bird is the rayed bittern of Latham, and some other British describers. On the second moult the longitudinal spots begin to disappear, the plumes on the neck are bordered with russet, and the feathers of the wings and tail begin to turn black.

This species is still less of a wader than the one last mentioned. It has no part of the leg bare of feathers above the tarsal joint, and the membrane which unites the middle toe and the external one at their basis is very short. Still it frequents the marshy grounds and margins of the waters, feeding upon young fry and very small fishes in the shallows, and also on the spawn and tadpoles of frogs, and on worms. It is a marsh-breeder, making its nest in bushes and tufts, and laying five or six white eggs.

It is wholly confined to the eastern continent, but there it has a considerable range, being met with as far to the north as Siberia, and as far to the south as Arabia. In the south and east of Europe it is very common, and it is by no means rare in Holland. In France it is not so abundant; and in England, and, as it is said, in Germany, it is only a bird of passage. Considering its size, it is a bird of long and powerful flight, and some of the specimens that have straggled to this country have been met with in the Orkney islands. Some describers mention that, during the breeding season, the male utters a cry resembling the

barking of a large dog when at a distance. In those places where it comes as a straggler it is not exclusively found close by the waters, as is the case with those herons which are more exclusively fishers; it ranges the moist meadows and damp corn-fields, but the former only where the grass is sufficiently tall for affording it concealment.

LOUISIANA HERON (*A. Ludoviciana*). This is, as its trivial name imports, an American species, but to the northward of Carolina it is seldom found on the Atlantic shores, nor does it advance far up the valley of the Mississippi in its northern migrations. It is not known as a resident bird in any part of North America, but its home is said to be in the marshy districts of the north parts of South America. Its length, from the tip of the bill to the end of the tail, is twenty-three inches; the long hair-like plumage of the rump, and lower part of the back, extends several inches farther; the bill is of considerable length, measuring at least five inches, of a yellowish green colour at the base, black towards the point, and very sharp; the irides are yellow; chin and throat white, dotted with rust-colour, intermingled with blue; the rest of the neck is of a light vinous purple, intermixed on the lower part next the breast with dark slate-coloured plumage; all the feathers of the neck are long, narrow, and pointed; head crested, consisting of, first, a number of long, narrow, purple feathers, and under them seven or eight pendent ones, of a pure white, and twice the length of the former; upper part of the back and wings light slate-colour; lower part of the back and rump white, but concealed by a mass of long unwebbed hair-like plumage, that bends over the tail and tips of the wings, extending three or four inches beyond them; these plumes, at the base, are of a dirty purplish brown, and lighten towards the extremities to a pale cream-colour; the tail is even at the tip, somewhat longer than the wings, and of a beautiful fine slate-colour; the legs and thighs, which are naked, are greenish-yellow, the middle claw pectinated; the whole of the under parts are pure white; the plumage of the male and female is alike, both being crested.

The tropical parts of America, New Holland, and the Eastern Islands, possess various species of herons, of which, generally speaking, the manners are but little known. Some of these appear to belong to the family of the true herons, and others more resemble the bitterns in some particulars. Of these, the *Agami heron* of the north parts of South America is a very splendid bird. The upper parts are bluish ash; the head and crest, which consists of very long feathers, are black; the nape and upper part of the neck bluish, the under parts and under tail-coverts russet brown, the bill black; the feet yellow, the rump furnished with long floating feathers of a dull blue colour; the belly spotted with white, the length about two feet and a half. It would, however, be impossible to enter into anything like a popular account of those tropical herons, both on account of the number of the species and from our ignorance of their manners. But there are still one or two deserving of notice, which migrate into the more temperate latitudes during the summer.

THE BLUE HERON (*A. caerulea*). There are blue herons in different parts of the world; and some are met with as distant as New Zealand; but the one with which we are best acquainted is an American species, resident in the tropical parts during the win-

ter, but migrating into the warmer and more southerly portion of the United States during the summer. It belongs to that division of the herons which have a slight resemblance to the bitterns. It is much less powerfully winged than some of the others. Its length nearly two feet, and the stretch of its wings about three. The bill black, with a bright purple streak extending from the nostril to the eyes; irides grey, with a narrow ring of a silvery colour round the pupil. The head and greater part of the neck deep purple brown; the crest-feathers narrow and pointed, and about six inches in length. The lower neck and the body generally of a deep slate blue with reflections of lighter colour. The back furnished with long, flat, and narrow feathers, some of them ten inches long, and reaching four inches beyond the tail; and there is a tuft of similar feathers on the fore neck or upper part of the breast. The legs are blackish green, and the claw on the middle toe is toothed like a comb on its inner edge. The breast, sides of the rump, and some other of the under parts, are furnished with a close cottony down below the proper feathers. The sexes are exactly alike in their general appearance; but the young birds are different. Though differing much in colour, this species appears to hold nearly the same place on the western continent as the squacco herons do on the eastern. When they retire at the approach of winter, they pass into Mexico, and all the intermediate parts; and in their southern rambles they probably reach the plains of Paraguay during the rainy season. In the extreme north of the United States they are rare; and in the middle States they are partial to the brackish water and the salt springs. They are tree breeders, and nestle in the tops of cedars, in the swamps, along with the night herons. The nests are constructed of small sticks, and the eggs average about four and are of a pale blue colour.

YELLOW-NECKED HERON (*A. violacea*). This is another of the American migrants, coming northward in the summer, and returning southward in the winter. It is rather a more southerly inhabitant than the one last mentioned, and is seldom met with farther north than the Carolinas, and even there it is not numerous, or much seen in proportion to its numbers, being a very shy and retiring bird. When we speak of the limits of a bird's migration in such a country as America, we must be understood as speaking of those places only to which the bird comes every year, and comes in considerable numbers; for among the rarer migrants of Britain, we occasionally find a pair straggling over to breed, while there is no regular summer residence of the birds within several hundred miles; and in North America, where there is no sea to interrupt migration, or cause a marked change of country upon the one shore and the other, the range of migration not only naturally but necessarily varies with the range of the seasons. If the season is backward and cold, the range will thereby be checked; and if, on the other hand, it is forward and warm, the range may be extended, in the case of a few of the birds at least, to a very considerable distance beyond the average. Hence this species of heron, though unquestionably rather a southern one, is occasionally found breeding in Virginia, and perhaps even farther to the north; and in those northerly parts the young birds are eagerly sought after, being highly esteemed as food. This bird is common in many parts of the West India islands, and great numbers are said to

breed in the Bahamas, and to feed on the fry of fishes and mollusca and small crustacea, which, in consequence of the currents of the sea there, are remarkably plentiful in the eddies of shallow water, in the creeks, and on the banks. It appears indeed that this species is more partial to the sea-coast, and feeds more on crustacea, especially on the smaller kinds of crabs, than any other heron of the western continent.

Its length, from the tip of the bill to the end of the tail-feathers, is about one foot ten inches, but the flowing plumes extend about four inches farther; the stretch of the wings is about two feet ten inches; the bill is about four inches in length, of a black colour, very stout, and having the upper mandible with grooves, like the bill of the night heron; the naked skin from the gape to the eyes is pale green, the irides flame colour, and the legs and feet yellow, with the middle claw toothed; the upper part of the head is white, and the crest is pure white and terminates in two narrow tapering feathers more than half a foot in length, and under these feathers there are a few mottlings of black. All the rest of the neck and the lower parts of the body are bright ash-colour, a little paler at the junction of the neck; the upper parts are dark ash, each feather with a white border and a black line down the centre; the quills of the wings slate blue with white edges, and the coverts the same colour but with pale buff borders. From the scapulars arise the produced feathers, which have long and tapering stems, and very loose and flocculent webs; they are ash-coloured with a broad streak of black down the middle; the sides of the head and upper part of the neck are black marked with a white spot on each side.

THE NIGHT HERON (*A. nycticorax*). This species, which is in some of its characters intermediate between the herons and the bitterns, but which appears to resemble the herons more in its manners, has been arranged and described as a separate genus; but though extreme scientific nicety may justify those very minute generic distinctions, it does not appear that they can contribute very much to any useful popular purpose; and therefore, to prevent repetition, and also to enable the reader to judge better of the distinctions between it and the typical herons, we introduce it here.

The night heron, or at all events a night heron, is found both on the eastern continent and on the western; and their manners, which is really the important part of the history of any bird, appear to be so much alike that they may be considered as the same species; and not more different from each other, even from the effects of climate, than some of those other species to which we have already alluded. They get the name *Nycticorax*, or night croaker, from the loud and disagreeable noise which they make during the night. In America they are vulgarly called *Qua-birds*, because the noise which they make has some slight resemblance to the sound of that syllable when pronounced in a manner as harsh and guttural as possible.

This bird, of which the new scientific name is *Nycticorax gardeni*, is very common in all the extensive swamps of both continents. In Britain they do not breed, and therefore we have no opportunity of observing the places of the nests, or the habits of the birds in their breeding quarters. Temminck says that it nestles on the ground in bushes, and very

rarely in tufts of rushes, and lays three or four eggs of a dull green. But Temminck is not always to be trusted with regard to the places in which birds breed, and consequently not more so with regard to the mode of placing their nests, however accurate he may be in the descriptions of the birds themselves. Wilson, on the other hand, says, that in America they build in trees; and assemble in greater numbers in the same breeding-place than even the common heron. His account of their manners is unquestionably the best, not only in point of correctness, as being obtained from his own observation, but as it combines the whole manners of the bird in one very well-drawn picture. We shall therefore quote his description, and then offer a remark or two on some differences which have been observed in the nesting-places of birds belonging to the same, or at all events to very nearly allied species on the eastern continent and in America.

"The night heron," says Wilson, "arrives in Pennsylvania early in April, and immediately takes possession of his former breeding-place, which is usually the most solitary and deeply shaded part of a cedar swamp. Groves of swamp oak, in retired and inundated places, are also sometimes chosen, and the males not unfrequently select tall woods, on the banks of the river, to roost in during the day. These last regularly direct their course, about the beginning of evening twilight, towards the marshes, uttering in a hoarse and hollow tone the sound *qua*, which by some has been compared to that produced by the retchings of a person attempting to vomit. At this hour also all the nurseries in the swamps are emptied of their inhabitants, who disperse about the marshes, and along the ditches and river shore, in quest of food. Some of these breeding-places have been occupied every spring and summer from time immemorial by from eighty to one hundred pair of qua-birds. In places where the cedars have been cut down for sale, the birds have merely removed to another quarter of the swamp; but when personally attacked, long teased, and plundered, they have been known to remove from an ancient breeding place in a body, no one knew where. Such was the case with one on the Delaware, near Thompson's Point, ten or twelve miles below Philadelphia; which, having been repeatedly attacked and plundered by a body of crows, after many severe rencontres, the herons finally abandoned the place. Several of these breeding-places occur among the red cedars on the sea beach of Cape May, intermixed with those of the little egret, green bittern, and blue heron. The nests are built entirely of sticks in considerable quantities, with frequently three or four nests on the same tree. The eggs are generally four in number, measuring two inches and a quarter in length, by one and three quarters in thickness, and of a very pale light blue colour. The ground or marsh below is bespattered with their excrements, lying all around like whitewash, with feathers, broken eggshells, old nests, and frequently small fish, which they have dropt by accident, and neglected to pick up. On entering the swamp in the neighbourhood of one of these breeding-places, the noise of the old and the young would almost induce one to suppose that two or three hundred Indians were choking or throttling each other. The instant an intruder is discovered, the whole rise in the air in silence, and remove to the tops of the trees in another part of the woods, while parties of from eight to ten make occasional circuits

over the spot, to see what is going on. When the young are able, they climb to the highest part of the trees; but, knowing their inability, they do not attempt to fly. Though it is probable that these nocturnal birds do not see well during the day, yet their faculty of hearing must be exquisite, as it is almost impossible, with all the precautions one can use, to penetrate near their residence without being discovered. Several species of hawks hover around, making an occasional sweep among the young; and the bald eagle himself has been seen reconnoitring near the spot, probably with the same design."

Such is the description of the manners of these birds, by perhaps the most observant and felicitous describer that ever lived; and it unquestionably points to habits very different from those mentioned even by what are considered the most accurate of European naturalists. Still, it by no means follows, from this difference of the nesting-place, that the night heron of America, and that of Europe, are different species, or even different varieties. Particular nesting-places are not the grand inducements which birds have to resort to certain places for the purpose of breeding. Food for themselves and their brood is the grand matter, to which every thing else must be subservient. This being the case, it follows as matter of course, that the birds must build in such accommodation as the locality which abounds in food affords them. If there are no trees in or sufficiently near the marshes, of course they cannot build in trees, however strong that instinct might be if there were the means of gratifying it. We believe that there is no wild duck, breeding in any part of the eastern continent, which places its nest any where except under a bush, or more frequently in a close tuft of aquatic plants; but there are many of the American species, breeding far to the north, which are known to breed habitually in the short bushy trees with which the northern marshes of America abound; and so much has this style of building become part of the general instinct of the birds, that some which were kept at the London Zoological Gardens, would not breed until posts were erected, with boxes on the top, as substitutes for the trees. Even in what is mentioned by Temminck, there is a sort of evidence that the night herons of the East would breed in trees if they could find such to breed in; for he remarks, that they breed under or in bushes, and rarely in tufts of rushes. Why the nest, in such situations, may be in many cases on the ground under the bush, is easily explained; for the bushes which grow on the margins of such marshes as afford no trees, are generally so weak and pliant that they could not support the nest of a heavy bird; and we know of no instance in which a bird places her nest so as that the weight of herself and her eggs would bring it down.

The remarkable difference between the breeding-places of apparently the very same species of birds, in the same continent, is a matter which ought to teach us a little caution as to what circumstances we are to consider as essential portions of the character of a bird, and what are to be regarded only as local or accidental, and, as such, admit of change with change of locality. It is very probable that the positions of nests, and the materials of which they are formed, have been by far too much regarded as constant characters of birds; and therefore it would be very desirable to know how any one species manages matters in these respects in countries affording very dif-

ferent situations and materials, before we come to any positive conclusion on the subject. In this respect, the case of the night herons is a very important one; and this is the reason why we have gone into it at so much length, and we shall now give some account of the appearance of the bird.

In doing this, we may remark, that there is a very considerable difference in size between the night heron as it occurs on the eastern continent, and as it occurs in America; and that there are some differences in this respect in different parts of the eastern continent. Twenty-two inches is the usual length in Europe, and twenty-four inches the usual length in India, where the bird is by no means rare. In America the length is twenty-eight inches, and the bulk of the body and extent of the wings are large in proportion, the latter measuring four feet from tip to tip.

This difference of size shows pretty clearly in what country the bird is most at home. America is decidedly the most favourable to it, and India is more favourable than Europe. Therefore, whatever habits the bird may have in America are justly to be regarded as its natural habits; and as one of the natural habits in America is to breed in trees, and collect in large societies in the same breeding-place, we may very safely conclude that this is the natural habit of the bird; and that where this habit is not accommodated, the bird is in so far put out of its way, and the result is, that it is dwarfed in its dimensions. This point may be considered as demonstrated in the case of the species in question; and a little careful observation in different places, and just comparison founded on this observation, would render the same principle applicable to any species of bird, or indeed to any other living production of nature. This is of far more value than any individual description, because it leads us immediately to the connection that exists between the living world and the rest of nature; and this is the most valuable instruction which natural history can give us.

The bill (in the American bird) is four inches and a quarter in length, from the angle of the gape to the point; the naked space from the eye to the gape bluish, and that round the eyes deep purple. The eye is large, being three quarters of an inch in diameter; the iris bright pure red, and the pupil black; the legs and feet are pale yellowish cream-colour, and the claw of the middle toe is toothed on the inner side. The crest on the head and hind head are deep blue, with green reflections, but the forehead and a bar across the eye are white. Pendent from the nape there are three very narrow and tapering white feathers between eight and nine inches long; the webs of these are concave, or curled inwards on their under sides, so that each embraces the one below it; and so difficult is it to derange the form of this graceful crest, that even if these feathers are ruffled in the skin of the dead bird, shaking them two or three times will bring them into their natural position. In consequence of this the three feathers appear only as one, and the bird has the power of erecting them when excited. The cheek, neck, and lower parts are white, with a tinge of yellowish cream colour, and with very pale ash-colour under the wings. The back and scapulars are of the same rich blue with green reflections to which we alluded as occurring on the head. The rump, the tail and its coverts, and the whole of the wings, are very pale ash-colour. Thus attired, the night heron, notwith-

standing its unmusical voice, is really a very beautiful bird; and from the number of noxious creatures that it destroys, it is very far from being a useless bird.

The female differs in nothing from the male bird, excepting that perhaps the ash-colour on the wings is a little darker; and those who have described the female as being without the crest have evidently confounded it with the young. In the young of the year the colour on the upper part is very deep brown, streaked with reddish white, and having triangular spots on the back and wings, which extend from the middle of the feathers to the extremity. The quills are dusky black, with a white spot on the tip; the belly white, with dusky streaks; the iris bright orange, and the legs and feet pale green. These colourings differ so much from those of the mature bird, that unless the fact had been ascertained by actual observation, the identity of the species would not readily be believed. In the second year the brown on the head and back still remains, but the whitish spots are smaller and less numerous. The spots on the wing-feathers are also smaller, and ash-colour appears on some of the quills. There is also generally a greenish tinge on the scapulars, and the under parts are whiter than in the birds of the year; the bill is of a blackish brown, the iris reddish brown, and the feet slightly greenish.

It does not appear that there is any difference of colour in birds of the same age, as they have been seen in Europe, in Southern Asia, and in North America; and indeed the only difference at all perceptible is that of size, already mentioned; and we believe that in this respect they are much more uniform in America than in Europe, which is another reason for concluding that they are more at home there.

Such are the outlines of a few of the more remarkable birds in the very numerous and highly interesting family of the herons. Had our limits permitted, we might easily have extended the list, though the extension would have, after all, been little else than so much mere description of shape and colour, which, considered in themselves, are matters of minor consequence. The species which we have enumerated, go, we believe, to the more striking characters and habits of the genus, whether as one, or as divided into sections.

HERON'S BILL is the *Erodium*, a genus of plants, defined and described by Le Heritier.

HERRING (*Clupea*, or rather perhaps *Clupeidæ*, the herring family). A genus of malaeopterygious, or jointed-rayed fishes, with abdominal fins; and, in an economical point of view, one of the most valuable of all the many inhabitants of the waters. They hold nearly the same place among fishes permanently inhabiting the sea, as the salmon family do among those who live in fresh water, or alternately in the salt water and the fresh; and though none of them at all approach the size of the more important of the salmon, and are not so much prized, their numbers, and the various ways in which they may be preserved, as well as the length of time that the preserved ones may be kept, and the distance to which they may be carried, add greatly to their value as an article of human food.

In addition to the characters already mentioned, it may be stated that the herring family differ from that of the salmon in having no adipose or fatty dorsal fin, but agree with the trouts in having the inter-

maxillary bones without pedicles. Their bodies are always very sealy; the greater number have an air-bladder and numerous œcal appendages to their intestines. They are chiefly sea fishes, but some peculiar ones are found in large fresh water lakes, and others ascend the rivers at least as high as the termination of the brackish water. The species, as well as the individuals, are very numerous; and they have sometimes been divided into different genera, though such division does not appear to render the study of them any easier, and therefore we shall not pay much attention to it. We have already given some account of two of the species, namely, of the *shad*, in the article *ALOSA*; and another, the *ANCHOVY*, we noticed under that title. We purpose in the present article very briefly to mention the more remarkable of the remaining ones.

THE HERRING (*C. harengus*). This is a fish so familiar to everybody that no formal description of it is necessary; and yet, strange to say, it is one respecting which very many absurdities have been written, and that even by naturalists who in some respects are worthy of commendation. The old opinion was, that these fishes, which retire from our shores at certain seasons of the year, and return to them at others, swam off *en masse* to the polar seas during the winter months, remaining there and enjoying some incomprehensible benefit from a frozen canopy over them, until the returning season, which in the commencement of winter had sent them from cold to colder, brought them back to warmer habitations toward the end of summer. What they may have done, or could have gotten, in the extreme north during the intensity of the cold, for they continue on some parts at least of the British shores till nearly the end of the year, the manufacturers and retailers of these most singular allegations have not apparently felt themselves bound to say. It will however be but right to hear Pennant on the subject, because he gives the story with all due pomp and circumstance. The opening of course alludes to their advance from the north, when, like so many Goths and Vandals of the ocean, they come to overrun and take possession of our more hospitable seas:—

“This mighty army,” says Pennant, “begins to put itself in motion in the spring. We distinguish this vast body by that name; for the word herring is derived from the German Herr—an army, to express their numbers. They begin to appear off the Shetland islands in April and May. This is the first check this army meets with in its march southward. There it is divided into two parts: one wing of those, destined to visit our coasts, takes to the east, the other to the western shores of Great Britain, and fill every bay and creek with their numbers; others proceed towards Yarmouth, the great and ancient mart of herrings; they then pass through the British Channel, and after that in a manner disappear. Those which take to the west, after offering themselves to the Hebrides, where the great stationary fishery is, proceed towards the north of Ireland, where they meet with a second interruption, and are obliged to make a second division: the one takes to the western side, and is scarcely perceived, being soon lost in the immensity of the Atlantic; but the other, which passes into the Irish sea, rejoices and feeds the inhabitants of most of the coasts that border on it. These brigades, as we may call them, which are thus separated from the greater columns, are often capricious in their motions,

and do not show an invariable attachment to their haunts." Now so far is this from being the true state of the case, that herrings are very rare in the polar seas at all seasons of the year; and the few that are met with in the extreme north belong to a smaller and much less valuable variety than that which is caught in such numbers on the British shores. In truth, the habit of the herrings, and, generally speaking, of the whole herring family, does not differ much in its great principles from that of the salmon, only the species with which we are acquainted do not ascend the rivers as the salmon do, though some of them approach farther up the estuaries than others. Their proper pastures, when their only objects are feeding and recovering their strength, after having been exhausted by the process of breeding, are the deep waters of the sea, at a considerable distance from the land. They are however, to a certain extent, surface fishes: and surface fishes, as we might expect, do not deposit their spawn under a very great depth of water; because a certain degree of action of the solar heat and light appears to be necessary for quickening the eggs into life; and not only this, but the maturing of the spawn within the bodies of the animals appears to require an approach towards the shores. Hence the herrings arrive off the coasts for some time before they begin to deposit their spawn; and this is the time at which they are most valuable for food, and caught in such numbers at the different fishing stations. Whether they breed every year, that is, whether, after having deposited their spawn for one year, they are ready to return with an equally productive load the next year, is a question which we cannot determine. It is not very probable that so excessive a production can go on year after year; but as we cannot follow those migratory fish which disappear from our coasts at certain seasons into the depths of the ocean, we cannot speak positively on this part of the subject. We may rest assured, however, that there is no very great migration in latitude in herrings or in any other species of fishes which inhabit the sea. It is indeed said that whales not only migrate, but migrate almost from the one pole to the other in the course of the year; but it will be recollected that whales are not only warm-blooded animals, but animals of comparatively high temperature; and that they not only come to the surface to breed, but feed with part of the body above water. Therefore we can easily suppose that the rigour of the polar winter might drive such an animal after the sun into more southerly latitudes. This, however, implies no necessity of migration in fishes, which keep constantly below the water, and are not only in their own temperature, but experience very little change in that of the medium in which they swim during the whole year. In our seas there is a slight difference of temperature of the surface water in summer and in winter; but it is doubtful whether this reaches to any considerable depth, and therefore we can assign no cause why herrings or any other fishes should migrate much in latitude.

The most rational opinion, and indeed the only one which has any thing like reason or philosophy in it, is that those fishes inhabit the deep water around our coasts at all seasons of the year when they do not approach near the land; and that their object in approaching the land is that of breeding as above stated. It is well known that they deposit their spawn on our shores, beginning in some instances in

the month of October, in others not till November and there are instances in which the operation is not wholly completed until nearly the end of December. When it is entirely over, and the fishes are on their return to the deep water, their flesh is exhausted and tasteless, and even unwholesome, and they are proverbially known by the name of "shotten herrings," which is a common expression for any thing worthless; but as long as they remain on the coast without having actually spawned they are in good condition; and we have certainly seen good herrings selling at the very moderate rate of forty a penny as late as the third week of December.

They approach the land in vast shoals, often extending many miles in length and breadth, and probably fathoms in depth; and sometimes, when those shoals are caught in severe gales, the fishes are stranded in numbers beyond all imagination. This usually happens during the violent gales which frequently occur about the time of the autumnal equinox, for that is the period of the year at which herrings approach our shores in the greatest numbers. In some of the lochs or arms of the sea, on the west coast of Scotland, they have often been cast ashore in such numbers that they were chopped up as manure for the land; and the writer of this article remembers a case, on the east coast of Scotland, when, during a strong gale from the north-east, an entire shoal was shipwrecked. It does not appear that herrings retreat in any considerable numbers to the cod-banks in the southern part of our eastern sea; and there are two reasons why they should not: in the first place, the water there is comparatively shallow; and, in the second place, the cod are most ravenous fishes, and would doubtless make terrible havoc of a shoal of herrings if it should come within their locality. Hence the greater number of those herrings which reach the more southerly parts of our east coast certainly do come from a little way north, and, in their passage, they keep between the cod-banks and the land; and as, during their migration shoreward, they come pretty near the surface, it is natural to suppose that, along with the surface-water, they should, to some extent at least, drift before the wind. In the case to which we allude, which occurred at the town of Crail, at the eastern extremity of the peninsula of Fife, a gentleman, on whose veracity we can rely, was spending a day with a friend at the outskirts of the town. The bellman passed, making a violent clatter, with not the most musical of all instruments, and then proclaimed, with stentorian voice, that any one who chose to go to the shore, meaning thereby the harbour of Crail, would get a cartload of live herrings for a shilling. This passed without much notice; but by and by the bellman again came round, proclaiming, that any one who pleased to resort to the shore of Crail would get a cartload of live herrings for nothing. The second announcement, of course, excited some speculation; and it was soon followed by a third one, that any one who would be kind enough to go to the shore of Crail would get a shilling for taking away a cartload of live herrings. This seemed something very extraordinary, and the party set off for the shore accordingly. Upon arriving there, they found that a shoal of herrings, on their way probably to the Frith of Forth, and the sandy beach between North Berwick and Dunbar, which are understood to be favourite places for the depositing of the spawn, had been driven inside the

reef of the Carr-rocks, and so stranded, and that, left by the ebb-tide, they lay in countless thousands for at least a mile and a half or two miles along the shore. The reason for the announcement was a fear on the part of the authorities in Crail that such a quantity of animal matter remaining to putrify on the beach would taint the atmosphere and cause disease.

At that time there was of course no danger; for though herrings, as is the case with all surface-fish, and with this family in an especial manner, die very soon after being taken out of the water, yet many of them were alive, and less injured than if they had been taken in the usual way, of being entangled in nets by the gill-lids. Thus they were there absolutely as a mine of wealth; but, unfortunately, the people could not avail themselves of them to the full extent of their value. There are salt-works, that is, works for obtaining salt by the evaporation of seawater, at no great distance, but, unfortunately, the impolitic, and, in cases like this, the most iniquitously cruel duty on salt then existed; and, though we believe there was a drawback of the duty upon salt which had been applied to the curing of fish, there was no warehouse bonding, or any other means by which a stock could be kept without actual payment of the duty in the first instance; and this was tantamount to a positive enactment that no stock should be kept,

There cannot be a more severe reproof of that ministerial cupidity, which, for the gratification of ambition, and the most unholy purpose of deluging the earth with human blood, ignorantly lays taxes upon everything, without knowing or caring what may be the consequences, than such a case as this. There was an immense quantity of human food, in the very finest condition, cast on the shore, without contrivance or labour on the part of man, as if it had been a miraculous instance of the bounty of Heaven; and yet the people could not avail themselves of that bounty because of the duty on salt! At the same time there was a Board for the Encouragement of the British Fisheries, with well-paid commissioners, and there were bounties given to *certain* successful prosecutors of the fishery. Fortunately for us, those times of "the blackness of darkness" in legislation have, in some measure, gone by, and perhaps the period is not very remote when they will be numbered among the fables of antiquity, which all wonder at, but none believe. In this case there was probably, however, more absolute loss from the want of salt than the whole salt-duty of Scotland amounted to in a dozen years. It may be said that the people of Crail could have kept a stock of salt, well knowing that, if a shoal of herrings should ground upon their coast, and they should use the salt in curing them, they would get the drawback. But this same system of drawback, while it leads to many acts of villany, is one of the most complete extinguishers of industry and enterprise that can be imagined. If there were no drawback, people would include the duty among the other costs of production, and so accommodate the article to meet contingencies, much in the same way as if there were no duty; but there never will be a surplus of that upon which a payment has been made, to be got back again under circumstances which are contingent; and thus the drawback has a more mischievous effect upon any manufacture than the same amount of duty without any drawback. Therefore, the sooner that all such mischievous laws are repealed the better.

In the cases alluded to, the people did what they could; they used all the salt in the towns and places adjoining; and they made signals, and sent messages, so that light craft came from some other places, and carried off part of the herrings in bulk; but the fish are too tender for such treatment, and only a small quantity could be taken, as there was enough to load a navy; and, therefore, the farmers of the neighbourhood carted off the far greater part, to be worked up in compost as manure.

Though there is no reason to believe that the herrings make any longer voyages than from the deep waters to the shore, to mature and deposit their spawn, and back again when that operation is completed; yet they are, to our apprehension, very capricious,—that is to say, they come in multitudes to certain parts of the coast for a greater or smaller number of years, and again totally abandon it, nobody can tell why. Of course there is no caprice in this; for, like all other occurrences in nature, it may have a natural cause; and the probable one is that the herrings, by resorting to one particular spot in such immense shoals as they do, exhaust that spot of the proper food for themselves and their offspring; and are under the necessity of seeking another haunt, until the store again accumulates in such quantity as to be adequate to their wants. Fat bottoms, where there is an eddy, or one current running against another, and consequently a deposit, appear to be the places which they prefer; and hence, the herrings in Loch Fyne, and some of the other inlets of the Atlantic, which have the middle of considerable depth, but the bottom rich toward the shores, are much larger and finer than those taken in water where there is little stagnation, and, consequently, little deposit. On the east coast we find the herrings richer in flavour in proportion as they are nearer to the banks, though, for the reason which we have already assigned, it is not probable that they naturally resort to those banks where cod shoal, although cod are much more bottom fishes than herrings. The exhausting of their food at any particular spawning-place is, however, the only natural reason that we can assign for the apparent caprice of the herrings; and we find it confirmed, or, at all events, rendered more probable, by the conduct of some other animals both of the sea and the land. Haddocks are not quite so capricious as herrings; but they often quit a particular spot after being abundant upon it for years. Salmon also desert rivers, not only in consequence of the quantity of deleterious matter in them (which is probably the cause of their having deserted the Thames), but also when only gravel is discharged into the stream. In forming the Caledonian canal, it was found necessary partially to change the bed of the river Ness. The cutting thrown into it was clean gravel; but in such quantity that, though the water was not at least very turbid all the way to the sea (about two or three miles), there was a constant deposit of gravelly matter on the bottom; and the salmon, in a great measure, deserted the river. The only probable cause of this desertion was that the gravel covered up the food either of the salmon or of their fry, most probably of the latter. We must not wonder that a salmon should cease to come for the purpose of spawning to a place where its young cannot find food; for, in all cases where the parent animal does not attend to the young, there is an instinct which guides

the parent to the proper *nidus*, with far more certainty than the reason of man can do it. These appear to be chief natural causes of the apparent capriciousness of the herrings, in respect of locality; and we have stated them at some length, because they will, with modifications for the several races, apply to every fish which has the same habit.

Some explanation of this kind is necessary, also, on account of the prejudices which exist on the subject. The disappearance of any valuable species of fish from a part of the coast on which they have been abundant for some time, is one of the most severe calamities that can befall the inhabitants; as great, in some instances, as if the blight of total sterility were to be sent upon the earth. This being the case, and more the case in proportion as the land is poorer, and the people more dependant on the sea, (which is saying, in other words, that they are very superstitious,) it is very natural that the people should assign causes for these apparent caprices; and, under the circumstances, it is hardly possible that they should assign any but superstitious and absurd ones. But there are perhaps no evils more prone to growth and spreading than prejudices; and thus, when they are entertained upon any one subject, they very speedily taint the whole character.

Some of the prejudices which are entertained respecting the disappearance of herrings from different localities on the British shores, are so very curious, notwithstanding their absurdity, that we shall notice them; and we cannot do better than by quoting from the late Dr. McCulloch, and we shall quote as from Mr. Yarrell's admirable work on British fishes, for the sake of introducing an Irish anecdote mentioned by that gentleman in supplement to the Scotch absurdities. "Ordinary philosophy is never satisfied," says Dr. McCulloch, "unless it can find a solution for every thing; and is satisfied, for this reason, with imaginary ones. Thus, in Long Island, one of the Hebrides, it was asserted that the fish had been driven away by the manufactory of kelp; some imaginary coincidence having been found between their disappearance and the establishment of that business. But the kelp fires did not drive them away from other shores, which they frequent and abandon indifferently without regard to this work. It has been a still more favourite and popular fancy, that they were driven away by the firing of guns; and hence this is not allowed during the fishing season. A gun has scarcely been fired in the western islands, or on the west coast, since the days of Cromwell; yet they have changed their places many times in that interval. In a similar manner, and with equal truth, it was said that they had been driven from the Baltic by the battle of Copenhagen. It is amusing to see how old theories are revived. This is a very ancient highland hypothesis, with the necessary modification. Before the days of guns and gunpowder, the highlanders held that they quitted coasts where blood had been shed; and thus ancient philosophy is renovated. Steam-boats are now supposed to be the culprits, since a reason must be found; to prove their effect, Loch Fyne, visited by a steam-boat daily, is now their favourite haunt, and they have deserted other lochs where steam-boats have never yet smoked." "A member of the House of Commons, during the session of 1835, in a debate on a tithe bill, stated, that a clergyman having obtained a living on the coast of Ireland, signified his intention of taking the tithe of fish;

which was, however, considered to be so utterly repugnant to their privileges and feelings, that not a single herring had ever since visited that part of the shore!"

Herrings, besides coming in great numbers to our shores, are exceedingly prolific; and the spawn being deposited in the end of autumn or the early part of winter, much about the same time as that of the salmon, quickens early in the spring; and, as the summer advances, the fry are found in countless multitudes along all the shores where the bottom is shelving, and the water shallow for some distance. Though the shoals of herrings are met with at particular points only, it is probable that they deposit their spawn along the whole line of the coast wherever the bottom is fit for the purpose; and thus immense quantities of fry are met with in places where there is no fishing. Thus, for instance, herrings are very rarely caught in the Tay; and yet, when stake-nets were erected in the estuary of that river for catching salmon, such multitudes of herring fry, or "herring-soil," as they are called generally, on the east coast, though with various pronunciations of the last syllable, got entangled in the nets, that at low water they were sometimes found lying ankle deep; and without any entanglement they may sometimes be taken in great quantities by simply letting down a basket and drawing it up again. So common indeed are they, that it is scarcely possible to use a small meshed net during the summer upon any part of the coast without capturing numbers of them; and the juvenile fishers at the points of piers, and jetties, and other situations where there runs of tidal water, catch them indiscriminately with the fry of the cod fish. They retire from the narrower parts of the estuaries at the end of summer, though in some of the broader ones they remain during the autumn, and do not rove far from the coast during the winter. Indeed it is by no means improbable that if the movements of grown herrings in the sea were properly traced, it might be so managed that they might be taken in a condition fit for use at all seasons of the year, at least if, as we are inclined to believe, the spawning is not annual.

Herrings are captured by means of what are called drift nets, that is, nets which are left in the sea, suspended from the surface, and descending only to a moderate depth. This is the usual method of catching all the surface fishes which swim in shoals, such as mackerel and pilehards, only the meshes of the net vary with the kind of fish. In such nets the fishes are not enclosed, but entangled in the meshes through which they attempt to pass, but are not able, neither can they retreat, as the threads of the mesh catch hold of their gill-covers, and thus they are often suffocated while in the net. These nets often extend to a great length, many miles belonging to the same proprietor in the larger fisheries; and these fisheries can be carried on to the proper extent only by persons of considerable capital. A proper equipment of nets, boats, and busses, with the men requisite to work them, requires an outlay of from fifteen to twenty thousand pounds; and after all, the fishery, at least that for sea fishery where such extensive nets are used, is in a great measure a lottery. Owing to the capricious habit of the fish, they may not come to the spot where the net is put down; and on the other hand, as the best fishing is about the time when the autumnal gales are most severe, the nets may be drifted out to sea and lost, by the action of the wind

upon the floats by which the drift-rope that supports the net is buoyed up. When a loss of this kind does occur it is peculiarly serious, as being the loss of the season as well as the property; and as the prevention of such losses, especially on the coasts of the Highlands, where the autumnal winds are very inconstant, requires a great deal of experimental knowledge of the weather, and intimate acquaintance with the various motions of the sea, the fishery cannot be conducted by adventurers, or indeed by any one who has not been bred to it on the spot; and if half the sum which has been given in bounties had been expended in training men for the task, there is no doubt that great advantage would have thence arisen.

In order to show the advantages of this fishery, we shall give an abstract of the returns of the whole produce of the fishery for 1815, and the four years following. "By the report of 1815, it appears that the quantity gutted and cured was $105,372\frac{1}{4}$ barrels. By that of 1816, it amounted to 135,981 barrels, being an increase in one year's fishery of $30,608\frac{3}{4}$ barrels. The quantity cured ungutted, in the former period, was 54,767 barrels; in the latter $26,670\frac{3}{4}$ barrels, being a decrease of $28,096\frac{1}{4}$ barrels. The total quantity brought under the view of the officers in 1815 was $160,139\frac{1}{4}$ barrels. In 1816 it was $162,651\frac{3}{4}$ barrels, being an increase on the whole of $2,512\frac{1}{2}$ barrels. The quantity branded for bounty in 1815 was 83,376 barrels. In 1816 it was 116,436, being an increase of 33,060 barrels. The exports on the whole in 1815 exceeded those of 1816; but the gutted herrings exported in the latter year exceeded those of the former by $12,606\frac{1}{2}$ barrels. In the year 1817 the total quantity caught was $192,343\frac{1}{2}$ barrels, being an increase of $29,691\frac{1}{4}$ barrels. In the same year the quantity branded for bounty was $140,018\frac{1}{2}$ barrels, being an increase of $23,582\frac{1}{2}$ barrels. The quantity exported in 1817 was $138,628\frac{1}{2}$, being an increase of $30,940\frac{1}{2}$ barrels. In the year 1818 the total quantity caught was 227,691 barrels, whereof $204,270\frac{1}{4}$ were cured gutted, and $23,420\frac{3}{4}$ ungutted; being an increase in the total quantity of $35,347\frac{1}{2}$ barrels, and of $48,494\frac{1}{4}$ in the quantity gutted; while there was a decrease in the quantity cured ungutted of $13,146\frac{3}{4}$ barrels. In this year the quantity found entitled to bounty was $183,089\frac{1}{2}$ barrels, being an increase of 43,071 barrels. In the same year the total quantity exported was $162,339\frac{1}{2}$ barrels, whereof $148,147\frac{1}{2}$ were gutted, and 14,192 ungutted; being an increase in the total quantity of 23,711 barrels, and of 32,667 in the quantity gutted; while there was a decrease in the quantity ungutted of 8956 barrels." The vast numbers in which these fishes are taken, and the readiness with which they find a market, more especially in the warmer countries, point out how very important they are to this country, and how worthy their history is of being studied with the utmost attention.

It may seem hardly necessary to give a description of a fish so well known as the herring; but we shall quote Mr. Yarrell's description, with a view both to show how a fish ought to be described, and how admirably this excellent naturalist has described this one, and indeed all others; and the specimen will no doubt induce such as are fond of the study of fishes, a study which deserves far more attention than it generally meets with, to take Mr. Yarrell as their guide to the whole finny tribes of the British waters. "The length of the head," says Mr. Yarrell, "compared to the length of the body alone, without the

head or caudal rays, is as one to four; the depth of the body, compared to the whole length of the fish, as one to five; the commencement of the dorsal fin half way between the point of the upper jaw and the end of the fleshy portion of the tail; the longest ray nearly as long as the base of the fin; the pectoral fin rather large compared to the size of the other fins. The ventral fin arises considerably behind the line of the commencement of the dorsal fin—this fin is small, with elongated axillary scales, its origin half way between the point of the lower and the end of the short central caudal rays; the anal fin begins half way between the origin of the central and the end of the fleshy portion of the tail, and extends over half the distance between its origin and the end of the fleshy portion, thus occupying the third quarter division of the distance between the origin of the ventral fin and the end of the fleshy portion of the tail; the rays very short; the tail considerably forked; the outer rays as long again as those of the middle; the fin rays in number are, dorsal fin seventeen rays, pectoral fin fifteen, ventral nine, anal fourteen, caudal twenty, spine consisting of fifty-six vertebræ, but the rays vary in some specimens to nineteen dorsal, seventeen pectoral, nine ventral, sixteen anal, and eighteen caudal. The lower jaw is by much the longer, with five or six small teeth extending in a line backwards on each side from the anterior point; four rows of small teeth on the central upper surface of the tongue; a few small teeth on the central portion of the upper jaw, and the inferior edges below the gape finely serrated; the eye large; its diameter, compared to the length of the head, as two to seven, and placed at the distance of its own breadth from the end of the nose; the dorsal and abdominal lines of the body slightly convex; the belly carinated, but not serrated; the scales moderate in size, oval, and thin. The upper part of the fish a fine blue, with green and other reflections when viewed in different lights; the lower part of the side and belly silvery white; cheeks and gill-covers silvery, exhibiting the appearance of extravasation when the fish has been dead twenty-four hours; dorsal and caudal fins dusky; the fins on the lower parts of the body almost white."

LEACH'S HERRING (*C. Leachii*). We are indebted to Mr. Yarrell for the first distinct account of this variety, though it had been previously noticed by others that there were some differences in herrings. This species differs from the common one in the shape being much deeper in proportion to the length, and more curved in the line both of the back and the belly. The eye is also much larger, and the scales smaller; the dorsal fin also is not placed quite so far behind the centre of gravity, so that when this fish is tried by the usual test of distinguishing a sprat from a herring, by the drooping of the herring's head when held by the dorsal fin, this one does not droop so much as the other. This species is met with on various parts of the British coasts; but, so far as is decided, not in such numbers in any one locality as the common herring. It may be, however, that this is the fish which is sometimes taken in good condition and full of roe in the middle of winter; and if so, there is a chance that, if proper attention were paid to this fishery, the herring might be obtained fresh for at least six months of the year; for this one comes in season as soon as the common herring goes out. The herring fisheries in the western and eastern seas of the north part of the island alternate with each other,

that of the west being over before the eastern one comes on ; and this would lead to a conclusion that there is a difference of species, or at all events of variety, between the herrings of those two seas. The usual way of explaining this was derived from the absurd notion of the annual pilgrimage of herrings from the pole ; and as that must be abandoned, we can only suppose that the herrings which come near the land at different seasons in places so little different from each other spawn at different seasons. It is probable that the common herring is the herring of the Atlantic, though the other is certainly met with there also ; and that the present species is the herring of the north seas, which inhabiting water of a colder temperature, is later in bringing its spawn to maturity. These however are points respecting which there must be a good deal farther examination before the difficulty can be cleared.

THE PILCHARD (*C. pilchardus*). The pilchard is a more southerly and more local fish than the herring ; being, as a British fish, found chiefly on the Cornish coasts, and it is rare indeed that one is met with beyond Dover, or even in the narrow part of the channel. The old story assigned the same pilgrimage to the pilchard as to the herring ; but it is now well ascertained to be resident on the coast of Cornwall all the year round, only it follows the instinct of the genus, by coming to the shore for maturing and depositing its spawn, and returning again to the deep water when these purposes are accomplished. In the cold months, they remain in the deep water ; and they are a little capricious in the times of their appearance in numbers near the land, though not so much so with regard to places as the herrings. Sometimes they come as early as March and April ; but July and August are the times of their regular appearance, the great fishing being in August and September, at which times they are taken both with the sear and drift net. They appear to deposit spawn very irregularly at different times of the summer. The motions of the shoals of pilchards are very capricious ; and therefore, though they are found on the same grounds year after year, a good deal of experience is requisite in order to be successful in the capture of them.

The description of the pilchard fishery given by Mr. Yarrell is highly interesting, but our limits do not admit of quoting. The most interesting mode is perhaps that with the sear. This is generally used in the sandy bays, and the fish, which are exceedingly timid, are driven into such a situation as that they can be enclosed by the net. When a large haul of fishes are enclosed in the net, and brought to the surface, the splutter and noise which they make in attempting to escape is very great ; but when the large sear is properly worked, and secured by grapnels, the fish can be taken from it in portions at a time, so that if the quantity enclosed is very great, the removing of the pilchards from the sear may occupy a whole week. The number of these fish which is captured is often very great. Two thousand or three thousand hogsheads have been taken by one sear in the course of a year ; and as a hogshead contains from two thousand to five thousand fish, the number is immense. Twenty-five millions of pilchards have sometimes been landed at one port in a single day, which is more than a pilchard a piece to every man, woman and child, in the three kingdoms ; and as this is only one out of three or four ports at which this

fishery is carried on, at the south-west of England alone, it is not too much to say, that local as the pilchard fishery is, it might be made to support while it lasts the whole people of the united kingdom.

Pilchards also occur in great numbers on the south-west of Ireland, the principal fishery being in Bantry Bay ; and they are found, though less abundantly, on the south-east and east of Ireland. They are likewise met with on the French coasts, and on those of Spain, but less abundantly on the latter ; thereby proving that the fishes are very local, and do not extend into the warm latitudes.

The pilchard is thicker and smaller than the herring ; the scales are large, they are periodically shed, and have a fringe at the posterior edge, which enables them to take a powerful hold on the water when swimming. The dorsal fin is nearly triangular ; and its posterior edge is nearly over the centre of gravity, so that when a pilchard is held by this fin, the head rises, and the tail droops down, which is the very reverse of what happens with the herring. In the average of pilchards there is one ray more in the dorsal fin, one more in the pectoral, one less in the ventral, four more in the anal, and one less in the caudal, and there is one vertebra less in the spinal column. It is probable though, however, that the number of rays in the fins are subject to variation, as is the case with the herring. The mouth is small and toothless, with the under jaw projecting beyond the upper ; and the food is understood to consist of the smallest insects and crustacea which inhabit the sea. The eyes are whitish yellow, the gill-covers bright yellow, the upper part bluish green, the sides and belly silvery, and the dorsal and caudal fins dusky.

THE SPRAT (*C. sprattus*). The old opinion that the sprat is the young or fry of the herring, is now exploded by all who are in the least acquainted with the habits and characters of fish, but it still continues a matter of popular belief in many places. Indeed, in a family of fishes which possess so much family likeness, and yet differ so much in size, it was perhaps natural to suppose, in the times of ignorance, that the smaller ones were the young of the larger. There is something in the succession of herrings and sprats which may lead vulgar belief this way, though to those who reflect on the matter the conclusion to which it leads is exactly the opposite. Sprats come near the shores in great numbers after the herrings are gone, but seldom if ever so long as these remain ; thus it was natural to conclude that the offspring followed the parents. But then the sprats come to the shores for the same purpose as the herrings ; and we never find the young of any species of seasonal fish making their appearance in numbers, or of a size worth catching, until a considerable time after the parent fishes have taken their departure. The herrings disappear in the beginning of winter generally, and the young herrings are not found till the end of spring, or the beginning of summer. Sprats appear in the beginning of winter, and continue the whole winter through ; and though there is no doubt that the young sprats are hatched some time about midsummer, yet they are not so much observed as the young herrings. Though sprats are small, they are not without their value ; because they are caught in vast numbers, and at a season when neither pilchard nor herring in the recent state is to be had. They are sold cheap ; but when recent and dressed

with due care, they make no unsavoury meal. It is necessary, however, that they should be recent; for there are few fishes that are sooner injured by keeping than sprats.

The sprat is a fish of the east coast of Britain rather than the west, and its favourite places are the estuaries of the rivers farther upward than the herring usually comes. Thus, in the north, the herring, though plentiful on the coast of Caithness, rarely comes far into the Moray Firth; while the best sprat fishing is in the arm of that Frith which extends beyond Inverness to Beaulieu. In the Frith of Forth the herring, even when most frequent in that locality, seldom goes above Kinghorn, or even as far, while the sprat ascends to the narrows about Inch Garvie; and on this account the vulgar name in that part of Scotland is "Garvie herring," or simply "Garvie." In the Thames, again, the sprat comes about the east of Kent, and partially round the North Foreland. On the east and north-east of Ireland, the sprat also makes its appearance; but it does not resort to any part of the coast which is exposed to the full roll of the Atlantic.

In the south of England the sprat fishing begins in November; but it is earlier in the north; and the fish is less esteemed there, because fish are more abundant and buyers fewer there than in the south. Sprats are caught with small-meshed drift nets, or with stow-boats. In this case two boats have a large purse-net between them kept open to the run of the water by two beams, one above the other, and six farther apart; the depth of the whole from the surface being a matter depending on local circumstances. The current carries the sprats into this great net; and when the proper time comes, the mouth of the net is closed by raising the lower beam. "All is fish that comes into a net" of this kind,—sprats, dory, anything. The quantity taken is often immense, and as counting is out of the question, they are sold by measure, sometimes at sixpence a bushel for manure. A full-grown sprat is about six inches long, and rather more than an inch in depth. They are eaten fresh, preserved in various ways, and sometimes manufactured into counterfeit anchovies.

WHITEBAIT (*C. alba*). Long as this fish has been celebrated by the more *recherche* *ichthyophagi*, for its delicate flavour, and the impossibility of getting it in perfection anywhere but at the few places where it can be had recently caught, it was not until within these few years, when Mr. Yarrell investigated its natural history, that the truth was known concerning it. This may seem singular; for there is scarcely a constellation of great men, right honourable, right worshipful, right learned, or, we believe we may add, right reverend, in the British metropolis, which would not from time immemorial have considered it a ban-yan year in the calendar, if they had not got their annual feast of whitebait at Greenwich, or in the vicinity. It may be true that, as the poet sings,

—————"dainty bits
Make rich the ribs, but banker out the wits;"

but still, when we consider that the most learned societies have been for so long a period doing the greatest justice to this little fish in a gastronomical point of view, it seems passing strange that none of them should have ever thought of being grateful to the little lord of the feast, and showing their gratitude by giving it a local habitation and a name upon the

scroll as a distinct species and perfect fish, instead of continuing to regard it as the young of the shad; for if they had used their eyes with half the zeal on the living fish that they no doubt displayed in their palates to the dead one, they would have seen that, if the offspring of the shad, this fish could not be legitimate. It is, perhaps, as well, however, that they let this matter alone; for we doubt very much whether any one individual, or, with great deference, any one society, however learned, could have done half the justice to the subject which has been done by Mr. Yarrell; and we, on our part, should be doing injustice both to him and to our readers if we did not quote a portion of his description, instead of substituting any thing of our own.

"About the end of March, or early in April," says Mr. Yarrell, "whitebait begin to make their appearance in the Thames, and are then small, apparently but just changed from the albuminous state of very young fry. During the fine weather of June, July, and August, immense quantities are consumed by visitors to the different taverns at Greenwich and Blackwall. Pennant says, 'they are esteemed very delicious when fried with fine flour, and occasion during the season a vast resort of the lower order of epicures to the taverns contiguous to the places where they are taken.' What might have been the particular grade of persons who were in the habit of visiting Greenwich to eat white bait in the days when Pennant wrote, I am unable to state; but at present the fashion of enjoying the excellent course of fish, as served up either at Greenwich or Blackwall, is sanctioned by the highest authorities, from the court at St. James's Palace in the west, to the Lord Mayor and his court in the east, including the cabinet ministers and the philosophers of the Royal Society. As might be expected, examples numerous and influential have corresponding weight; and, accordingly, there are few entertainments more popular or more agreeable than a white-bait dinner. The fishery is continued frequently as late as September; and specimens of young fish of the year, four and five inches long, are then not uncommon, but mixed, even at this late period of the season, with others of very small size, as though the roe had continued to be deposited throughout the summer; yet the parent fish are not caught, and are believed by the fishermen not to come higher up than the estuary; where, at this season of the year, nets sufficiently small in the mesh to stop them are not in use. The particular mode of fishing for whitebait, by which a constant supply during the season is obtained, was formerly considered destructive to the fry of fishes generally, and great pains were taken to prevent it by those to whom the conservancy of the fishery of the Thames was entrusted; but since the history and habits of this species have been better understood, and it has been ascertained that no other fry of any value swim with them,—which I can aver,—the men have been allowed to continue this part of their occupation with little or no disturbance, though still using an unlawful net."—*Yarrell's British Fishes*, vol. ii. pp. 127, 128.

The only other British locality in which its historian mentions that this fish is to be found, is "the Hamble, which runs into Southampton-water;" but, as he very justly believes, this is owing, "rather to the want of a particular mode of fishing, by which so small a fish can be taken so near the surface, than to the absence of the fish itself; which, abounding as it

does in the Thames, I have very little doubt might be caught in some of the neighbouring rivers on our south and east coasts." This is certainly highly probable; and the same remark, doubtless, applies to other fishes which are usually said to be very local. We are, in general, very ignorant of the habits of fishes; and modes of fishing are the most local of all arts; so that in all cases in which there is any great similarity between one part of the water and another, it is always worth while to try, if what is got in the one could not be got in the other also, by using the same means.

The common whitebait net is small, only about three feet each way in the opening. It is put over the side of the boat, moved in a depth of from three to five fathoms, and let down to the depth of only about four feet. The fish come with the flood, but never ascend beyond the brackish water. This alone might have shown that they were not shads, as these often go many miles up the fresh. The heat produced by the mixing of the fresh and salt water is the stimulating cause which brings them, and also the reason why they move up and down with the tide. On this account they are not very likely to be found in any but tidal rivers, in which there is a considerable range of the tidal play.

Farther down the estuary of the Thames, whitebait are sometimes caught of larger size than on the grounds usually fished, and they are also caught nearer the bottom, and in deeper water; but while whitebait is the chief fish caught on the stations farther up, it arrives only as a straggler in those more seaward places; and, as is known to be the case with the pilchard, and supposed to be the case with the herring, it keeps more to the bottom as it gets farther out to sea. Whether it might not be followed into these localities, and taken by deeper nets than those now used; or rather, whether it might not be met as it returns from them, is a point worthy of investigation. We know, that in the case of salmon, the more seaward they are taken they are the better; but this may not hold in the case of white-bait, or, indeed, in that of any of the herring family. Herrings, themselves, are better when they are taken in the quiet bays, with fat bottoms, and the same may hold true of all the family. For salmon are fishes of colder latitudes, and hence they do not select the top of the brackish water, where the greatest heat is, for their spawning-places, but pass into the fresh of the rivers, and even, in some instances, hundreds of miles inland; although, as an article of food, their quality deteriorates from the moment that they quit the fully saturated water of the sea, or, at all events, the open sea water of the places to which they resort.

Whitebait, as is the case with the whole herring family, are very tender in their vital system; and, true to the general character of all animals which are thus tender, their flavour very speedily falls off, and they soon become putrid and unwholesome. They are so very delicate that they cannot even be carried to any great distance in boats which are provided with wells. They can therefore be had in perfection only in the immediate vicinity of the places in which they are caught, and the sooner they are dressed after being taken out of the water the better. This is an additional reason for ascertaining whether they may not be found in other rivers besides the Thames and the Hamble. In order to contribute our humble

mite to the ascertaining of this, we shall add a short description of the appearance of these very interesting little fishes; and it would be worse than affectation to attempt doing this in any other language than that of Mr. Yarrell.

"The length of the head," says Mr. Yarrell, "compared with that of the body alone, is as two to five; the depth of the body, compared with the whole length of the fish, as one to five; the dorsal-fin commences half-way between the point of the closed jaws and the ends of the short middle caudal rays; the longer ray of the dorsal-fin is as long as the base of the fin; the ventral-fin arises behind the commencement of the dorsal, and half-way between the point of the closed jaws and the end of the largest caudal rays; the tail long, and deeply forked. The fin-rays in number are—

"Dorsal, seventeen; pectoral, fifteen; ventral, nine; anal, fifteen; and caudal, twenty. The vertebrae of the spinal column are fifty-six.

"The head is elongated; the dorsal line less convex than that of the abdomen; the scales deciduous; the abdominal line strongly serrated from the pectoral fin to the anal aperture.

"The lower-jaw the largest, and smooth; the upper slightly crenated; the tongue with an elevated central ridge without any teeth; the eye large; the irides silvery; the upper part of the back pale greenish ash; all the lower parts, the cheeks, gill-covers, sides, and belly, silvery-white; dorsal and caudal fins coloured like the back; pectoral, ventral, and anal fins, white. The only food I could find in the stomach were the remains of minute crustacea."

This description, which is equally accurate and circumstantial, will enable any one who takes an interest in the seasonal fish of any of our rich tidal rivers to know this much-famed species, and if only one is found in a river, that will be sufficient to justify a fair trial with the whitebait net properly constructed and worked; for these fishes always come in shoals to their breeding-places, and very rarely straggle. From what Mr. Yarrell says of the food of this, the smallest and most delicate of the herring family, it is highly probable that the whole family feed upon those small crustacea and other little creatures which float in countless myriads in the sea, and are very much at the mercy of the currents, so that, according as those currents shift in their setting against each other, the fishes which feed on the living load of the water may also require to shift. This may, in part at least, explain why the herrings are so apparently capricious on our eastern shores. Those shores have a current of tide from the north parallel to the general line of the coast, while, on the opposite coast of the continent, the tidal movement is in the reverse direction, or to the north, as far at least as the entrance of the Baltic. There is thus a general eddy and deposit of whatever is suspended in the middle of our eastern sea; and in the different estuaries and embayments along our east coast there are of course smaller eddies, which in like manner make their deposits, though to an inferior amount. The variable winds, and the action of the land-floods in the upper estuaries, must have considerable effect upon the eddy water which collects those little creatures that are taken up from their birth-place on the shores; and the removal of the food by this means, *en masse*, may co-operate with the consumption of

the fish in producing those periodical famines in some localities which drive the fish to others. But the free ocean, when once arrived at, is common to all; and the margin of the great central eddy, and of its banks, to which these fishes retire, are not subject to the same vicissitudes as the bays and estuaries. It is highly probable that there are also seasonal movements of great part of the food of these fishes, seaward at one time, and shoreward at another. No doubt many of even the very smallest crustacea carry their eggs attached to the under part of the body, and thus continue in the free water all the year without, in all probability, ever reaching the bottom. There are other creatures, however, upon which the herrings feed, which do deposit their eggs upon some substance, such as rocks, and more especially seaweed. There is a limit of depth, and want of solar action, beyond which no seaweed will grow, as is found by the bottom, which the deep sea lead always shows, being ruins, such as mud and broken shells; and we cannot suppose that any living creature will place its eggs beyond this limit of all vegetable action.

Even those small and floating crustacea that hatch their eggs on their own bodies, cannot so hatch them in the depths, but must come both near the surface and near the land, in order to enjoy the light and heat of the sun, the reflected and radiated heat of the bottom, and the stimulus of the atmospheric air. All these come to their maximum toward the end of summer, and thus the parent little creatures come shoreward at that time, and during the winter. At the same time the broods of the former year, having enjoyed the action of the sun and air near the shore during the summer season, begin to retreat in the winter; and thus, as these seasonal fishes approach the land, they are led by one part of their food, and they recalc another.

The system is so beautifully contrived, too, that though all the productions of our seas are seasonal, their seasons are not all the same. Thus they come in succession to support each other, and with that surplus which is so very valuable to man, when he is industrious enough to avail himself of it. The subject is one upon which it is not easy to get accurate information, and it has been, for this reason, neglected. But still there is no subject in nature more interesting to a maritime people than the seasonal movements and actions of the sea, of which surface-fishes, and, above all, the herring family, are in a great measure the keys.

HESPERANTHA (Ker). A genus of Cape bulbs, belonging to the natural order *Irideæ*. They require the same treatment as the *Ixia*, &c.

HESPERIIDÆ (Swainson). A family of diurnal lepidopterous insects, or butterflies, distinguished by several remarkable characters. They are, for the most part, small dull-coloured butterflies, extremely active, flying with great velocity, but resting frequently upon leaves and twigs. Their hind tibiae are furnished with two pair of spurs, as in many moths, and the antennæ are short and clubbed at the extremity, have the tip bent into an acute hook; when at rest, the lower wings are elevated, the upper pair being extended horizontally. The spiral tongue is as long as the entire body, which is very robust. The caterpillars, of which a few only are known, are elongated, naked, with a large head and sixteen legs.

When full fed, they fold the adjacent leaves together with the help of silken threads, within which they become chrysalides, which are not angular like the majority of butterflies, but short and smooth with a slender transverse thread. By English collectors, these butterflies are termed skippers, from their short and irregular jerking kind of flight. These butterflies, which were called by Linnæus, *Papilioes Plebeiæ urbicolæ*, were formed by Fabricius into the genus *Hesperia*, from which several others were subsequently detached. We have been surprised to observe that, in Mr. Dunean's recent work upon British Butterflies, these insects have been, for some unexplained reason, entirely omitted. We presume that this is an oversight, for the author will scarcely venture to assert that they are not butterflies, although, in some of their characters, they approach the moths.

The British species, (of which there are ten recorded, some, however, being doubtful natives,) were introduced by Fabricius into his genera *Thymele*, having the antennæ terminated in a curved club with an acute hook at the top, (comprising *Hesperia Alveolus*, and *Tages*,) and *Pamphila*, having the club of the antennæ straight and terminated by an acute hook, containing *Hesperia Paniscus*, *Linea*, *Sylvanus*, *Comma*, and some others.

The exotic species are very numerous, being mostly of a brown or dusky colour, with paler, white or talc-like spots on the upper wings; some of them are furnished with long tails to the posterior wings.

HESSIAN FLY. A minute dipterous insect, exceedingly destructive to wheat in America, belonging to the genus *CECIDOMYIA*, which see for an account of its ravages and figure of the insect.

HETEROCERIDÆ (MacLeay). A small but interesting family of coleopterous insects belonging to the section *Pentamera*, and subsection *Philhydra*; the body is small and oval but depressed, the antennæ with the seven terminal joints forming a serrated mass, the tibiae flat and spined, and the tarsi four-jointed only. The species are found in moist situations, preferring the muddy banks of standing water, in which they burrow by means of their tibiae, which are adapted to that purpose. There is one genus in the family, *Heterocerus* (Bosc), in which there are six British species.

HETEROGYNA (Latreille). A subsection of aculeate hymenopterous insects, distinguished, as the name implies, by the diversity in appearance of the female from the ordinary type of the order. Latreille introduces into this subsection the family of the ants (*Formicidæ*), which are gregarious, and in which the neuters or abortive females are wingless; and the family *Mutillidæ*, in which there are only two distinct sexes, the females being wingless. This sex is generally destitute of ocelli; the antennæ in all the species are elbowed, and the tongue is small, rounded, or spoon-shaped. Notwithstanding the diversity occasioned by the apterous condition of the females, it appears to us that the *Mutillidæ* are in no wise related to the ants, and that they are closely allied to the fossorial sand wasps, which they closely resemble in their habits.

HETEROMERA (Latreille). A section of coleopterous insects of great extent, of which the investigation is very difficult, but which are distinguished by having only four joints on the posterior tarsi, whilst the four anterior tarsi are five-jointed. Latreille divides the section into four subsections.

1. The *Melasoma*, having the elytra hard, claws simple, maxillæ with a hook, wings generally wanting. Families *Pimeliidæ*, *Blapsidæ*, *Tenebrionidæ*.
2. The *Taxicornes*, having the elytra hard, claws simple, maxillæ without a hook, wings present, antennæ perfoliated or clavate. Families, *Diapriidæ*, *Cossyphidæ*.
3. The *Stenelytra*, having the elytra hard, claws simple or toothed, wings present, antennæ simple. Families, *Helopidæ*, *Cistelidæ*, *Serropalpidæ*, *Edemeridæ*, and *Mycteridæ*.
4. The *Trackelides*. Elytra flexible, claws bifid, wings present, head inserted upon a neck. Typical genera, *Lagria*, *Pyrochroa*, *Mordella*, *Anthicus*, *Horia*, and *Meloe*.

HETEROPTERIS (Humboldt). A genus of climbing and shrubby plants, natives of tropical America, belonging to *Malpighiaceæ*. Some of them are handsome and easily propagated.

HEUCHERA (Linnæus). A genus of North American perennial herbs belonging to *Saxifragææ*. They grow well in any light soil in the open borders.

HEYNEA (Roxburgh). Indian ornamental trees belonging to the *Meliaceæ*. They are in our stove collections, and are propagated by cuttings.

HIBBERTIA (Andrews). A genus of climbing evergreen and deciduous shrubs, natives of New Holland, named in honour of George Hibbert, Esq., a distinguished collector of plants. Class and order *Polyandria Trigynia*, and natural order *Dilleniaceæ*. Generic character: calyx of five persisting sepals; corolla of five petals; stamens seated below the germen, filaments filiform, bearing oblong anthers; styles three or five, diverging and bent; seed-vessels several united, membranaceous, one or two-seeded. These are rather showy plants, with yellow flowers, but evolving a disagreeable scent. They are extremely easy of culture in the greenhouse.

HIBISCUS (Linnæus). An extensive genus of arboreseent, suffruticose, and herbaceous plants found in every quarter of the world. Among themselves, the *Hibiscii* assume so many forms that botanists have divided them into twelve sections. They have generally showy, some of them magnificent, flowers, and form an interesting group in the natural order *Malvaceæ*. Several species have been employed in medicine and domestic economy. The stems of almost the whole consist of strong and tough fibres, so that they have been manufactured into cords and whips, such especially as *H. cannabinus*, *arboreus*, *clypeatus*, and *mutabilis*. The leaves of the two former are also eatable, and those of *H. esculentus*, as well as its fruit, are esteemed as food in the Levant. The petals of *H. rosa sinensis* are astringent, and are employed by the Chinese to make a black dye for their hair and eyebrows, and a blacking for shoes. The aromatic seeds of *H. abelmoschus* have been much lauded as stomachics, and they are added as a cordial by the Arabians to their coffee. The mucilage procured from the root of *H. manihot* is used in Japan as size, and to give a proper consistence to paper. The whole are easy of propagation.

HICKORY TREE is the *Carya alba* of Nuttall, a genus of North American timber trees, formerly called *Juglans squamosa* of Poiret.

HIERACIUM (Linnæus). An extensive genus of herbs, chiefly European, vulgarly known by the

name of hawkweed. They are chiefly perennials, and found every where in meadows and dry pastures. Their colour is yellow, and resemble the flowers of the dandelion, only more numerous and much smaller. A few of them, particularly the *H. fruticosum*, a half shrubby one from Madeira, is esteemed as a greenhouse plant, but the generality are mere weeds. They belong to the natural order *Compositæ*.

HIMANTOPUS—Stilt or Longshanks. A very singularly formed bird, arranged by Cuvier in the snipe section of long-billed wading birds, but which does not appear to range very correctly in this part of the system, at least if we are to consider the order in the ordinary acceptation of *Grallæ*, or wading birds. Cuvier's *Echassiers* is not indeed so objectionable as *Grallæ*, but it is only not objectionable because it is not definite, unless the subdivision lead us in some way to the haunts of the birds. Indeed the birds under consideration are so peculiar that it is not easy to say what should be their place in the arrangement.

The generic characters are: the bill long, slender, depressed in the basal part, but compressed toward the tip; the nasal channel, extending half the length of the bill, and the nostrils of a lineal shape and long; the legs very long, much more so in proportion to their length than in any other bird, and as disproportionately slender as they are long. It is from this that the bird is called *Himantopus*, which means "cord legs," the legs being feeble and flexible as well as long. The feet have three toes, all turned to the front, the outer and middle ones being united with a broad membrane at their bases, and the inner and middle ones by a very small membrane. It is not easy to point out the kind of surface for which such feet are best adapted; but the birds are most frequently seen in waste and sandy places near the banks of rivers and the shores of salt lakes. The wings are also remarkable for having the primary quills much longer than any of the others. There are at least two species, one of the eastern continent, and the other of America.

COMMON STILT (*H. melanopterus*). Top of the head, back, and wings, black, with green reflections in the male only; tail dusky grey; and all the rest of the plumage white, except a few streaks of dusky grey on the hind part of the neck. The bill is about two inches and a half long, the head and neck four, the body four and a half, and the tail two. The legs, when stretched out, extend at least five inches beyond the tail; they are bare of feathers for two or three inches, and are of a pale red colour, as are also the irides. The wings are long and much pointed, and the bird is evidently well fitted for flight. The body of the bird is lightly and handsomely formed, and the colour of its neck is particularly graceful. As a British bird, the stilt is a very occasional straggler; and we are thus ignorant of its habits. On the continent it is much more common, and therefore its habits are better known, though even there it is a bird of desert places.

But though not very often seen near the habitations of man, it is a bird very generally distributed. On the eastern continent it is found as far to the north as the salt marshes in the south of Russia, and the confines of Siberia. It is particularly abundant about the shores of the Caspian Sea and the lake of Aral. It is by no means rare in India, not only about the

great salt marsh, the Runn of Cutch, but in the Decan. It is met with in Egypt, and probably along the margin of the desert to the Atlantic coast of Africa; and specimens have been sent from Brazil, differing very little from those that inhabit and breed in Europe. There is one circumstance connected with the differences of its appearance in different countries, which shows that it is more a bird of the warm latitudes, which have seasons of wet and drought, than of the temperate or the cold. In India it is much larger than in Europe, the length being at least six inches. Those which have been brought from Egypt and from Brazil, are also larger than the European; and even those from the south of Europe are larger than those from the north. We have already explained, in the article HERON, why any animal should be considered as most at home in that country where it is most fully developed; and the stilt furnishes a proof of what was there stated.



Stilt.

In all these localities it is a gregarious or social bird, occurring in flocks which, from the arid nature of the places which they inhabit, are rather discursive and often on the wing. In respect of food, it appears to be partial to miscellaneous vegetable matters, the larvæ of aquatic insects, and very small shells have been found in the stomachs of those that have been examined.

In all the west of Europe they are migrant birds, and though they are not uncommon in the north of France and the Netherlands, where they appear to arrive by the way of the Danube to the Rhine, they are by no means so common in that part of France which is most directly cut off from the range of eastern birds by the Alps. The few that have appeared in England have been only one at a time; and there is no account, or even probability, of their breeding in this country. They have, however, bred in the north of France; but their principal breeding-places in Europe are the marshes on the lower Danube and in the south of Russia, though at certain seasons of the year they appear in flocks about the salt lakes and salt marshes of Hungary. Their nests are understood to be in the closest herbage of the marshes; but though they flock they breed so obscurely that their habits at those times are little known. The nest is said, however, to be constructed very rudely of a

few withered stems and leaves, or other vegetable debris; the eggs being five or six in number, of a yellowish colour spotted with reddish brown, and about the size of those of a partridge.

BLACK HEADED STILT (*H. nigricollis*). This is an American species, differing in some particulars from that of the east, and as we have the advantage of Wilson's observation and description of it, it is much better known than that species, of the existence of which naturalists have been so much longer aware.

The black headed stilt measures about fourteen inches from the tip of the bill to the extremity of the tail, and the extent of the wings is about twenty-eight inches; the bill is about three inches long, slightly curved upward, and tapers to a very fine point. The upper mandible is rounded on the culmen, the nostrils are in the form of slits, but open, and the whole bill is of a black colour; the front of the head, a streak under the eye, and a spot behind it, and also the whole of the under parts, are pure white, which is also the colour of the actual feathers of the back, the rump, and the wing-coverts, but these are concealed by the mantle of long feathers issuing from the scapulars; a streak in front of the eye, the ear-coverts, the back of the head, the back-neck, the long feathers on the scapulars, and the quills of the wings, are deep black with rich reflections of green; the tail is square at the end, or very slightly forked, and the under coverts extend as far as the feathers; the legs are of a fine pale carmine red, the tarsi four inches and a half long, and the tibiæ naked for a considerable distance above the tarsal joints; they are remarkably slender, and can bear to be bent to a considerable curve without injury; the feet are the same as in the eastern species; the wings are very long, extending beyond the tail nearly two inches, and they are very much pointed; there are some differences as to the distribution of white and black upon the neck; and the female, as is the case with the eastern species, is considerably smaller than the male. The stomach of this bird is a true gizzard, that is to say, it is very strong and muscular, though it appears to feed much more on shelled mollusca and coleopterous insects than upon vegetable substances.

Wilson appears not only to have examined it with greater care, but to have formed a more correct estimate of its place and occupation in nature than has been done by the naturalists of Europe; and as there is a very close resemblance between the two in every thing save colour, and not very much difference in that, we may consider the same observations as being applicable to both.

He considers it as coming nearer to the avoset than to any other bird; and if the two are carefully compared it will be found that while the avoset brings the series to the water from the soft billed birds, the snipes and godwits, the stilt brings it from the harder billed birds, the plovers and sandpipers. The avoset wades, and scoops the mud in the runs of water, finding its food by the touch of the bill more than by the sight of the eye; while, though the stilt is also a wader, it does not scoop the mud, or feed by the touch of the bill, but catches its prey by sight in the water, in the air over it, or on the aquatic plants. The length of the avoset's neck, as compared with that of its legs, points out that it is fitted for feeding

at the level on which it stands; but in the stilt, though the neck is long and has a good deal of action, it is still so short in proportion to the legs, that the bird could not keep its balance, and reach with its bill the level on which it stands. Our common name stilt is therefore the most descriptive one that can be given to it; for it is really a bird "on stilts," that is, elevated for action above the plane of the feet.

This will give us at least a notion of the climates and localities for which the stilt is best fitted; and if we find these to accord with the actual ones in which it is observed, then we may safely conclude that we have found a clue to the use of the bird in nature, different as it is from those birds with which we are most familiar.

Now, the form of the legs in the stilt clearly shows that it is to wade in water, not beyond its depth of course, but still where its bill, long as it is, cannot reach the bottom; and though the slight turn upwards of the bill shows that the food is to be taken from a level below the common axis of the body, yet not so far below as in the case of the avoset. The legs of the avoset are also stout, to give it a firm base as it wades; whereas those of the stilt are very light and flexible. The foot too has the character of a swift foot, but the flexible leg does not answer to it upon land. The lightness of the foot, however, enables the bird to lift it in the water with very little exertion, and the flexibility of the tarsus makes it far less liable to injury from striking against obstacles in the water than if it had been a hard bone of the same weight. Thus, singular as this leg appears at first sight, when we come to examine the matter a little attentively we find that it is the very best foot for wading in shallow water,—in the same way as every thing in nature which our ignorance considers an imperfection becomes a perfection.

Such is the adaptation of the bird; and our next step is to find the places for which it is adapted. Shallow waters replete with living creatures are obviously the places; and wherever shallow water is exposed to powerful action of the sun, so as to have its temperature considerably increased, such water instantly becomes the stimulus to a vast number of living creatures; the larvæ of the larger water flies, water beetles, small crustacea, and univalve mollusca. The tropical countries, where they get flooded by the rains, furnish such places at one season of the year; and the shallow marshy pools of more temperate countries furnish the same during the summer; and it so happens that, in the northern hemisphere, which is the great hemisphere of seasonal migration, these alternate with each other. Thus we at once see that the stilt should be a migratory bird, and in what places it ought to be found. We have gone at some length into this subject, because the bird is a very singular one, and performs a very singular office in nature—a part peculiar to itself, as it were, in which it has no rival; and we have also done so because we believe there is no English work which gives any tolerable account of the economy of this bird, however correctly some may describe its appearance. As lawyers say, we have "taken the argument" upon the American species rather than the European one, because we can call Wilson as evidence; and if he bear out the case, we are sure of a verdict even from the most fastidious reader. We shall not mutilate the account given by the great ornithologist of America, though it is a little lengthy.

"This species arrives on the sea coast of New Jersey about the 25th of April, in small detached flocks of twenty or thirty together. These sometimes again sub-divide into lesser parties; but it rarely happens that a pair is found solitary, as, during the breeding season, they usually associate in small companies. On their first arrival, and, indeed, during the whole of their residence, they inhabit those particular parts of the salt marshes pretty high up towards the land, that are broken into numerous shallow pools, but are not usually overflowed by the tides during the summer. These pools or ponds are generally so shallow, that, with their long legs, the avosets can easily wade them in every direction; and as they abound with minute shell fish, and multitudes of aquatic insects and their larvæ, besides the eggs and spawn of others deposited in the soft mud below, these birds find here an abundant supply of food, and are almost continually seen wading about in such places, often up to the breast in water. In the vicinity of these bald places, as they are called, fifty yards off, among the thick tufts of grass, one of these small associations, consisting perhaps of six or eight pair, takes up its residence during the breeding season. About the first week in May, they begin to construct their nests, which are at first slightly formed of a small quantity of old grass scarcely sufficient to keep the eggs from the wet marsh. As they lay and sit, however, either dreading the rise of the tides, or for other purposes, the nest is increased in height with dry twigs of a shrub very common in the marshes, roots of the salt grass, sea-weed, and various other substances, the whole weighing between two or three pounds. This habit of adding materials to the nest after the female begins sitting, is common to almost all other birds that breed in the marshes. The eggs are four in number, of a dark yellowish clay colour, thickly marked with large blotches of black. Their nests are often placed within fifteen or twenty yards of each other; but the greatest harmony seems to prevail among the proprietors. While the females are sitting, the males are either wading through the ponds, or roaming over the adjoining marshes; but should a person make his appearance, the whole collect together in the air, flying with their long legs extended behind them, keeping up a continued yelping note of click, click, click. Their flight is steady, and not in short sudden jerks, like that of the plover. As they frequently alight on the bare marsh, they drop their wings, stand with their legs half bent, and trembling, as if unable to sustain the burden of their bodies. In this ridiculous posture, they will sometimes stand for several minutes, uttering a curring sound, while, from the corresponding quivering of their wings and long legs, they seem to balance themselves with great difficulty. This singular manœuvre is, no doubt, intended to induce a belief that they may be easily caught, and so turn the attention of the person from the pursuit of their nests and young to themselves. The red-necked avoset practises the very same deception in the same ludicrous manner, and both alight indiscriminately on the ground, or in the water. Both will also occasionally swim for a few feet, when they chance, in wading, to lose their depth, as I have had several times an opportunity of observing. The name by which this bird is known on the sea coast is the stilt or tilt, or longshanks. They are but sparingly dispersed over the marshes, having, as has been already observed,

their particular favourite spots ; while, in large intermediate tracts, there are few or none to be found. They occasionally visit the shore, wading about in the water, and in the mud, in search of food, which they scoop up very dexterously with their delicately-formed bills. On being wounded while in the water, they attempt to escape by diving, at which they are by no means expert. In autumn, their flesh is tender and well tasted. They seldom raise more than one brood in the season, and depart for the south early in September. As they are well known in Jamaica, it is probable some of them may winter in that and other of the West-India islands." The above is not only by far the best description of the manners of this genus of birds, but there are few descriptions of any living creature at all comparable with it.

HIPPARCHIA (Fabricius ; SATYRUS, Latreille). A very extensive genus of lepidopterous insects, belonging to the section *Diurna*, or butterflies, and family *Nymphalidæ*, having the antennæ gradually thickened to the tip, the club being slender and bent ; the body is slender ; the wings large ; the palpi are longer than the head ; several of the basal nerves of the wings are very much swollen at the base. The caterpillars are either naked or downy, with a forked tail ; the chrysalides have the head forked, and the back tubercled. There are nearly a hundred European species of this genus, of which nearly twenty are inhabitants of this country, including the wood argus (*Ægeria*) ; the wall butterfly (*Megæra*) ; the grayling (*Megæra*) ; the marbled butterfly (*Galathea*) ; the gate keeper (*Tithonus*) ; meadow brown (*Janira*) ; the ringlet (*Hyperanthus*) ; and the small heath butterflies (*Pamphilus*) ; all of which are of common occurrence and of the middle size.

HIPPOBOSCIDÆ (Leach.) A family of dipterous insects, belonging to the section *Pupipara* (or order *Homaloptera*, Leach), containing the forest flies, which exhibit such remarkable variations in their typical structure, that they have been regarded by some authors as forming a distinct order. The head is received into a cavity in front of the thorax ; it is divided transversely into two parts, the anterior or smaller of which supports the mouth and two small tubercles, almost imbedded at the lateral angles, being rudimental antennæ. The mouth is composed of two curved setæ, inclosed in a tubular canal, covered by two narrow elongated coriaceous plates, regarded by Latreille as palpi. The ocelli are wanting. The body is short, flat, and very coriaceous ; the wings are either large or entirely wanting ; the nervures of the anterior margin are very strong, but they are effaced behind. In the winged species a pair of balancers are also present. The legs are very strong, and terminated by robust curved claws, which are toothed beneath. The abdomen is composed of a continuous leathery-like membrane, capable of very great distension, which peculiarity is owing to the remarkable circumstance that the young of these insects are singly nourished within the body of the parent, where they not only acquire their full size, but actually assume the pupa state, under which form, like very large eggs, they are deposited by the females. This egg-like cocoon is at first soft and white, nearly as large as the abdomen of the parent fly ; but by degrees it hardens, becomes brown, of a rounded form, and often notched at one end, which is covered by a shining kind of cap, which

is detached on the insects assuming the perfect state. This cocoon is, moreover, entirely destitute of annular incisions, in which respect it differs from those of other dipterous insects. It is composed of the uncast skin of the larva, beneath which the insect becomes a real inactive pupa, with the limbs of the perfect insect laid along the breast as in other species which undergo the strict coarctate species of transformation. These curious particulars were first discovered by Reaumur, and have been subsequently confirmed by M. Leon Dufour, and others ; the former author was, indeed, so solicitous to observe the development of the insect from these singular eggs, as he at first supposed them, that he carried them in his pocket by day and took them to bed with him by night, in order that they might have the same warmth which they enjoy in their proper habitats. His surprise may therefore be imagined, when, instead of grubs, as he expected, perfect flies were produced.

These insects are not less interesting in respect to their habits : they live exclusively upon various quadrupeds and birds ; the horse is especially subject to the attacks of one of these species, which has thence been named *H. equina*. This species is the type of the genus *Hippobosca*, in which the eyes are large and distinct, being placed at the sides of the head ; the antennæ are in the shape of tubercles with three dorsal setæ ; the wings are large. Mr. Curtis observes, that "these flies move swiftly and, like a crab, sideways or backwards ; they are very tenacious of life, and live principally upon horses, attaching themselves to the belly, between the hind thighs and under the tail, where they are less protected by hair. It is remarked by Latreille, that the ass fears them the most, and that horses suffer very little from them, probably when they have overcome the irritation which they must at first occasion, they cannot cause much pain, otherwise horses could not live in forests in the summer." And Mr. Samouille states, that "in the New Forest of Hampshire, they abound in a most astonishing degree. I have obtained from the flanks of one horse six handfuls, which consisted of upwards of a hundred specimens. Mr. Bentley informs me, from observations he made in the summer of 1818, while in Hampshire, that the *Hippoboscæ* are found in considerably greater abundance on white and light coloured horses than those of a black and dark colour ; and the observation was confirmed by the stable-keepers in the vicinity of the Forest."

The other genera are, *Ornithomyia*, *Craterina*, *Oxypterus*, *Hæmobora*, *Melophagus*, *Feronia*, *Lipoteptna*, and probably *Braula* ; of these, the three first are British, and are found upon various birds, the *Craterina hirundinis* depositing its egg-like cocoon in the nest of the swallow, where it receives all the necessary warmth, for which it repays the poor swallow by sucking its blood. The wings in this genus are very long and narrow. The genus *Melophagus* comprises a single species, *M. ovinus*, which is destitute of wings, and attacks the sheep. It is of a dark reddish colour, with the abdomen whitish. It is commonly called the sheep louse, and is so tenacious of life, that Ray states that it will exist in a fleece twelve months after it is shorn ; its excrements even giving a tinge to the wool, which is very difficult to be discharged.

HIPPOCASTANÆ. A natural order containing only two genera, namely, *Æsculus*, the horse-chestnut, and *Pavia*, the scarlet-flowering chestnut. The different species of *Æsculus* and *Pavia* are

commonly known under the name of horse-chestnuts, reference being obviously made to the external resemblance the fruit bears to that of the *Castaneæ*, and the very bitter astringent taste, which renders it unfit for human food. The seeds are large, and abound in farinaceous matter; hence they are very nutritious, and some animals devour them greedily, especially after the nuts are steeped in lime water. If allowed to germinate they become sweeter, and then are relished by rabbits and pigs. The bark of the horse-chestnut is bitter and astringent, and has long been esteemed as a febrifuge. This tree, though very common in this country now, was unknown in Europe three centuries ago. Parkinson says "our christian world had first the knowledge of it from Constantinople," and, as an evidence of its rarity, Clusius states, that there was only one tree of it at Vienna in his time. The horse-chestnut is one of our finest flowering trees, and on this account is frequent in park scenery.

Some of the *pavias* bear beautiful scarlet flowers, and, as ornamental trees, will be very generally planted. The timber of neither is durable, and only used by turners. The horse-chestnut is readily raised from seeds, and the *pavias* are increased by grafting on the former.

HIPPOCRATEA (Linnæus). A genus of climbing plants, natives of the East and West Indies. They belong to the third class and first order of Linnæus, and to a natural order, to which they give a title, namely,—

HIPPOCRATEACEÆ. This is a small natural order of plants, comprising five or six genera, being climbing shrubs, or trees, with in general smooth stems, opposite, simple, somewhat leathery leaves, entire or toothed, and furnished with small deciduous stipules. The inflorescence is axillary, paniculate, or in bundles, and the flowers small, regular and united. The *Tonsella*, one of the genera, are said to bear poisonous fruit. Such of the genera as have been introduced into British collections are propagated by cuttings.

HIPPOCREPIS (Linnæus). A genus of annual herbs, and trailing or shrubby perennials, one of them is a native of England, and called the horse-shoe vetch from the resemblance of its crooked pods. They belong to the natural order *Leguminosæ*, are sometimes seen in flower borders, and raised from seeds, which ripen plentifully.

HIPPOMANE (Linnæus). *H. mancinella* is the Manchineel. A lofty tree, native of the West Indies, so called from its effects on horses which eat of it. The flowers are monœcious, and it belongs to the order *Euphorbiaceæ*. The hippomane is certainly a dangerous plant; but the poisonous properties of it have been very much exaggerated. The timber is beautifully veined with brown and white, and capable of receiving a high polish; but before the trees are felled, fires are usually lighted round them, to inspissate the sap, and render the feller's occupation less dangerous; for, even when the juices are not applied to produce death, they cause intense pain, likened to the burning of a red-hot iron. The plant is kept in our stoves, and grown in sand and moor-earth, and is easily propagated by cuttings.

HIPPOPOTAMUS. A remarkable genus of pachydermatous mammalia, of which there is only one living species known, inhabiting the larger rivers of Africa and their margins, and feeding on the strong and coarse aquatic plants. The elephant and the rhinoceros, among animals of this class,

bring us to the very margin of the water, though it must be a margin where there is a strong coat of vegetation to support the steps of such heavy animals. The hippopotamus follows these two, and brings us actually into the water, in which the animal chiefly resides during the day, often with nothing but the nostrils above the surface. We shall, perhaps, find a future opportunity of showing that the pachydermata, as they remain now, are the fragments of an animal population which was once far more numerous, more widely distributed, and more characteristic of the earth than it is now; but we may in the mean time remark, that pachydermatous animals are the only large mammalia found native on some of the more remote isles of the Pacific.

The name *Hippopotamus*, or "river horse," which has, from the earliest times been given to this animal, occasioned many mistakes on the part of the elder naturalists with regard to its appearance and character; but as the animal is now well known, it is not necessary to advert to these mistakes of the darker ages.

The generic characters are: four toes on all the feet enclosed in little hoofs at their extremities; six cheek teeth on each side of both jaws, the first three of which, toward the front, are conical, and the three posterior ones furnished with two rows of points on the crowns, which, in time, wear down into a sort of trefoil form. There are four incisors in each jaw: the upper ones short and conical, bent inwards towards the mouth; the under ones long, cylindrical, and pointing forwards. Canines in both jaws, the upper ones nearly straight, and the lower crooked; the two acting strongly against each other.

The body is heavy and massive, the legs very short, and the belly almost in contact with the ground. The head very large, more so in proportion even to the large body than the head of any other mammalia; but this size arises from the great production of the bones of the mouth and those that afford insertion to the muscles which move the jaw, and not to any superior development of the cranial cavity, which, on the other hand, is comparatively small. The muzzle is large and thick, so as to cover the powerful armature of the mouth. The tail is short, the eyes and ears small, the coat without fur, and of a dark and repulsive colour. The whole aspect of the hippopotamus is repulsive. It has a very stupid look, and yet its air is ferocious; and its mouth, though not in any respect of a carnivorous character, is about as ugly a mouth as can well be imagined.

Still the hippopotamus is by no means destitute of interest, and that interest is heightened when we reflect that, as a species, it stands alone in its genus, and occupies a place in nature which could be filled by no other existing animal. On land it is a very awkward walker, not only on account of the shortness of its legs, but because its body is specifically heavier, or understood to be so, than most other animals. This probably enables it to keep its footing in the water much better than if its specific gravity were more nearly the same. Its usual motion in the water is not swimming, but walking, though it can swim, as indeed most of the Pachydermata can readily do. It frequents the muddy banks of the rivers, usually where the vegetation is rank, is seldom out of the water during the day, but comes to the land to feed during the night. Though dull as well as ferocious in its disposition, it is very timid on land, as if it felt

itself not at home there ; for upon the least noise being made, or alarm given, it takes to the water, plunges to the bottom, and only raises the nose above the surface occasionally for the purpose of breathing. When it plunges into the water, it makes a great splash, and the flood covers its descent with foam and rippling. It also can expire the air which it has in its lungs when under the water ; and this causes that bubbling of the water to which allusion is made in the account of *Behemoth* in the Book of Job, which, no doubt, alludes to the hippopotamus, as the *Leviathan* is, in all probability, the crocodile of the Nile. The best authorities (for it is a question of authorities) ascribe the Book of Job to Moses ; and from his education in Egypt, the crocodile and the hippopotamus must have been the aquatic animals with which he was best acquainted. *Behemoth* appears to have had, among the Hebrews, the same meaning as "brute" has with us ; that is, a heavy animal feeding upon vegetable matter ; and "behemoth" is usually translated "cattle," in distinction to the more general word "beast," although the use of that as a general term is improper. "*Behemoth* on a thousand hills," is the expression which, in the common version of the Bible, is rendered "the cattle on a thousand hills." Now there is no inhabitant of the waters to which such an epithet can be properly applied, but the hippopotamus ; and it is remarkable with what truth the characters of the animal are marked by the inspired writer.

It is probable that, in the days of Moses, these animals abounded in the Nile throughout Egypt ; for mention is made of them in the streams of the Delta at a more recent period of history. Now, however, they are not found in Lower Egypt, nor in any part of the Nile below the cataracts. They do occur in the upper parts of the river, though probably not in such numbers as they did in former times. Burkhardt says, "The hippopotamus is very common in Dongola. It is a fearful plague there on account of its voracity, and the want of means in the inhabitants to destroy it. It often descends the Nile as far as Sukkat. In 1812, several of them passed the Bahr el Hudjar, and made their appearance at Wadi Halfa and Dan ; an occurrence unknown to the oldest inhabitants. One was killed by an Arab by a shot over the eye. The country people ate the flesh, and the skin and teeth were sold to a merchant of Sioutt. Another continued its career northward, and was seen beyond the cataract of Assauan at Deran, one day's march north of that place." Their descents to the north are, however, of rare occurrence ; and the hippopotamus must now be considered as an animal of the central and southern parts of Africa only.

Above the cataracts of the Nile, where the country becomes broader and more fertile, these animals are much more abundant. In Senaar they inhabit both branches of the river, and in their nightly excursions on shore they are very destructive to the crops, not only eating great quantities, but trampling down the rest with their large and clumsy feet.

They are long animals, not less than ten or eleven feet from the nose to the tail ; but they do not stand higher than between four and five feet. Their steps, also, are very short, so that they make an absolute rut in passing over soft ground. The quantity which they eat is enormous, much greater than that eaten by any other known animals. The stomach can contain five or six bushels, and the large intestine is at least eight inches in diameter. It is not without

reason, therefore, that the people dread their visits. It is true that their digestive powers are not great, or rather, perhaps, that their ordinary food contains but little matter fit for their nourishment. Their mouths are adapted for tearing and dividing hard and tough plants, but not for grinding any substance to a pulp, as is done by ruminating animals. Half their cheek teeth are, as we have said, conical and pointed, so as not to be in any way grinding teeth, and the remaining ones are also but ill fitted for such a purpose. Besides, though they have a compressing motion of the jaws which is very powerful, they have no lateral or grinding motion, and all that their mouth can do to the food is to bruise it a little. Thus the stomach does not dissolve any of the ligneous or harder part of the food, but merely extracts a portion of the juice, so that the great mass of the food passes off in a state comparatively little changed. As compared with most other animals, there is but a small portion of what is taken into the mouth that goes to the nourishment of the body ; and thus the animals may be said to be always burdened with the refuse of what they swallow. Most of the pachydermata have the functions of digestion less perfect than those of other herbivorous animals ; and if it is of very hard consistency, they only draw a tincture from it. This is the case with the horse, which, although like the hippopotamus, wholly a vegetable feeder, differs the most from it in many respects of any animal in the class. The hog, which is more omnivorous, does the same, at least when it does not get food which is succulent, and then it fattens more than any other animal. In England, where horses are much fed upon dry food, there still remains so much substance in it, that the grains which they drop on the roads serve for food to a vast number of birds.

As the hippopotamus appears to feed upon more coarse and rough substances than any of the order, not excepting the elephant and the rhinoceros, neither of which has the teeth at all fitted for tearing substances of the same toughness. The very peculiar teeth of the elephant, if we except the tusks, which do not in any way act in the taking or preparing of the food ; the teeth are all grinders, or rather bruisers ; and although the rhinoceros has two cutting teeth of considerable size and strength in each jaw, yet the majority are bruising teeth. Neither of those animals could therefore subsist on the same kind of food as the hippopotamus ; and not taking their food into the stomach in so rude a state, or of a nature containing so little nutriment, they do not require it in such vast quantities in proportion to their bulk.

This very peculiar mode of feeding fits the hippopotamus for the very rudest life of all the mammalia. Its office is to clear the rivers of those vegetable remains which, if allowed to accumulate in countries where vegetation is rapid, and the rains fall heavily in their seasons, would choke up all the passages, and turn all the flat lands into at least periodical marshes ; and in order to fit them for this very laborious service, they are exempted from some of those labours to which other animals are subjected. When in the water they are supported on all sides by the pressure of that fluid, so that the weight remaining to press on the feet is small, as compared with that of the whale ; and there is also much less waste of the body of an animal that keeps the water, than of one exposed to the air. Besides, they are not so much infested by those insects which are near the water, and which

give so much annoyance to many mammalia, as if they were in the free air, though, like the other pachydermata, they wallow in the mud. These considerations may help us in forming a guess at what may have been the condition of the globe when hippopotami were much more numerous than they are now; for though there are adaptations to climate in the external covering which have nothing to do with the internal anatomy of animals, yet when we find a skeleton of a definite type, and know the living animal to which it answers, we can always make pretty sure of the food and manner of feeding of the species of which we actually know only the bones.

The hippopotamus is found in the rivers of Western Africa, and also in the larger ones near the Cape, but it has been rarely seen in the former of these localities, though much more frequently in the latter. It is not found near the sea in any place so much as in the interior, and those places which have strong vegetation, and where the banks are liable to seasonal overflow by the water. These are the places in which its peculiar services are most wanted, because they are the places where the water-courses are most liable to be choked up by vegetable remains. Those places which are the favourite haunts of the hippopotamus are also the favourite haunts of the crocodile; and on the banks of the Upper Nile, while the one tramples down and eats the crops, the other often carries off the people. Lord Prudhoe, who travelled in Sennaar in 1829, mentions numerous instances of depredations by these formidable reptiles. He did not see any one carried off, but places were pointed out at which such things had occurred only a few days before. In one of those instances a crocodile snatched up a man who was washing clothes on the bank of the river, and instantly made for the opposite side with its prey; but, in the passage, another crocodile saw the prize, and followed the first, when a fierce battle ensued between them. Though crocodiles usually feed on the land, they fight better in the water, and so they plunged into the river to finish their combat in due form. In the meantime, the dead body of the man—drowned, not bitten, to death, which is the habit of crocodiles—was removed and buried, so that the reptiles had only their fight for their pains.

But though the crocodiles are thus formidable to man on the great rivers of the interior of Africa, it does not appear that they offer the least annoyance to the hippopotamus. That animal is truly the monarch of the wild flood. Neither lion, nor any other carnivorous beast, attacks it. This is not on account of the thickness of the skin; for, though the skin is about half an inch in thickness, and stiff, it is not hard, or destitute of sense of pain.

The skins of the Pachydermata are almost all very sensitive to the attacks of insects; but for even a lion to spring upon a hippopotamus would be rather a perilous matter, as the animal would instantly plunge, dive, and drown the lion. On the other hand, the crocodile could not make much of the hippopotamus. In the first place, no crocodile could carry off so large an animal; and, in the second place, the mouth and bite of the hippopotamus are by far the most formidable of the two; and though, in its natural habits, the hippopotamus bites only vegetable substances, yet it would of course bite an animal in self-defence; and, from the size, the form, and the hardness of the teeth, and the great force with which they can be made to act, there is little doubt that its bite would

be more formidable than even that of a lion. Its mouth is not, to be sure, a killing one, but, if applied to an animal, it would mangle dreadfully. Thus, while this savage and powerful, though dull and sluggish animal, lives at comparative peace, on its own part, with the whole of animated nature, it is perfectly indifferent to all that are around it.

Still these animals are not without their battles; for it seems to be a very general law of nature, and, for aught we know, it may have its physiological use in keeping up their energy, that, in all the more powerful animals which are vegetable feeders, the males fight desperate battles of gallantry. Horses, bulls, rams, and many others, are terrible in their amatory wars, while even the most savage of the carnivora rarely fight upon this account. The same holds good in the case of birds; and we believe that the pugnacious beetles, which are engaged with each other as a gambling sport in some parts of the east, are vegetable feeders. We are sometimes apt to attribute these excitements wholly to the heat of the sun and the season; but the fact of such battles taking place among the hippopotami, which are constantly bathing in the cold flood, shows that there is something in the nature of the animal, and that the propensity is stronger in proportion as the animal is more vegetable in its feeding.

When lying on the bank of a river, the hippopotamus seems a vast and shapeless lump, and one would hardly take it to be an animal. The eyes are small, even if open; the ears are also small; and, though the legs and tail are very stout, they are short. There is also a want of muscular marking on the body, for, if the animal is at all in good condition, there is always a thick layer of fat over it. This fat, in the recent state, and when the animal is obtained from the water, is of some consistency; but it contains less stearine than even the fat of the hog, and thus soon passes into oil, and becomes rancid from the putrefaction of the cellular substance with which it is mixed, when it is exposed to the warm air, and especially to the direct action of the sun. The Dutch inhabitants of Southern Africa, who call the hippopotamus the *zee-coe*, or "sea cow" (though it is never found in the sea), are very fond of this fat, which they call *spek*, the name given to the fat of the whale, and also to that of the hog; and when they succeed in killing the animal, they preserve this fat by salting it, usually allowing all the fat which they cannot remove to drain from the muscles as oil, and drying these in the sun, as a harsh, but not unwholesome food. The greater number of the Pachydermata have a tendency to accumulate soft fat or lard under the skin, and this tendency is always the greater in proportion as the animals are more aquatic in their habits. In this respect the hippopotamus exceeds all the rest, making the nearest approach to the *Cetacea* of any footed animal, and hence we find in it the greatest tendency to the accumulation of this kind of fat. There is no doubt that it answers the same purpose in all these animals. An aquatic habit, or even a habit of wallowing much in the mire and sludge of rivers, is inconsistent with the possession of a thick furry coat, by which the animals could be protected from changes of temperature; and the substitute for this is the coat of fat under the skin, fat being, like fur, a bad conductor of heat. The transition from the water to the air, on the part of the hippopotamus, is almost as great a change in tempera-

ture as the instant change from midsummer to midwinter would be in our latitudes, and thus the animal requires a natural protection against it, so that the muscles, and especially the vital organs, may not be subjected to violent shocks.

It is true that the hippopotamus seldom comes to the land, or even to the surface of the water, during the day, but still the night air in such places is much warmer than the water. Fat, when melted, does not resist the passage of the action of heat so much as when it is not, and the readiness with which the fat of this animal melts in the sun may be one of the causes which keeps it in the water during the day; for, when the fat of a living animal passes into oil on or in its body, the consequences are very serious, as the cellular tissue in which the fat is enclosed soon putrefies, and spreads corruption through the system. The colour of the skin, which, though it varies a good deal in different individuals, is generally of a dingy bluish black, also tends to keep these animals under water during the heat of the day. This colour is one which rapidly absorbs the heat; and it is worthy of remark, that this is the prevailing colour of the upper part of almost all those mammalia which inhabit the waters, and in this uniformity of colour we must presume that there is a uniformity of use. From this habit of keeping the principal part of the body under water during the day, which appears to be a necessary result of the structure of the hippopotamus, it is rarely seen, and comparatively little is known of it in proportion to its numbers. We cannot positively state even what is the style and rate of its march upon land; and we say that it must be slow, rather from our judgment of the power of the animal, than from the fact as actually observed. For the same reason we know little of its habits when breeding, or whether the males are polygamous or not. The circumstance of their fighting would lead us to conclude that they are polygamous, but still the conclusion is only a conjectural one. For similar reasons the animal is seldom shot, unless by very expert marksmen. Large as it is, it offers but a small mark to the sportsman; for, in general, the nose, the eyes, and the ears, are the only parts above the surface, and these are all so near the plane of the face, that that is very little elevated. A bullet, unless it happens to hit very obliquely, will readily penetrate the skin at any part; but it is difficult to get any aim except an oblique one at the visible part; and if the part under the water is aimed at, the bullet is very apt to glance.

When only the face of the animal is above the water, the straight outline and erect ears give it some resemblance to the face of a horse, that is in the general contour. This may have been the reason why it at first got the name of the river-horse; but a very small portion more of the animal appearing destroys all similarity. The "sea-cow" of the boors of Southern Africa is still worse, for it has no connection whatever with any of the ruminant animals. Some have proposed to call it a hog; but although that is one step nearer than the horse, it also gives a false notion of the animal, because it has none of the habits, and very little of the appearance of a pig.

Wherever the hippopotamus is seen attempts are made to kill it, if the people are in possession of any arms fit for the purpose. This is done in cultivated districts, chiefly on account of the mischief that it does; but the flesh, the skin, and the teeth are all of

some value. We have already mentioned its use as food. The skin is not of much use as leather, and in cold climates it gets hard and brittle; but the skins of those that are killed in the Nile are made into a kind of whips, which are held in considerable estimation in that country. For this purpose the recent skin is cut into triangular stripes, about five or six feet long, pointed at the one extremity, and gradually increasing in breadth till, at the other extremity, the breadth is equal to the circumference of the intended whip at the thick end. The stripe is then rolled into a conical pipe, tied firmly together, and dried in the sun, after which it keeps its shape, and is light, dry, and elastic. The teeth, that is the large canines, are more remarkable for the compactness of their bone or ivory, and the hardness and beauty of them, than the teeth of almost any other animals. They are not teeth growing from roots, but tusks placed on cores, and hollow for about half their length, like the tusks of elephants. As is the case with all tusks which grow in this manner, such as those of the elephant and the morse, the substance of them is ivory, but it is ivory of very fine grain and remarkably hard and tough. The enamel, of which there is hardly a trace in the tusks of the elephant, is very thick, and so hard that it strikes fire with steel. They are in fact the strongest of all known animal substances: they are very much sought after by dentists for making artificial teeth, and when a piece can be had of such a form as that the teeth can be worked in the enamel, they preserve their colour almost as well as the natural teeth. On this account the tooth sells for about a guinea and a half a pound, though half the tooth is unfit for the dentist's purpose; and from its great solidity it is very heavy in proportion to its bulk. The teeth of the mouse come nearest to these, but they are very inferior.

The female hippopotamus is said to go nine months with young, though the fact has not been ascertained with precision; and the young are very soon able to take the water, in which the females are well able to defend them from enemies.

Though this singular genus of animals is now reduced to one species, and that existing merely as a fragment in one part of the world, and obviously upon the decline, yet the remains which are met with in the earth show that it has once been a general and characteristic inhabitant of at least all the temperate parts of the eastern continent. Of the middle of Asia, indeed, we cannot say much; first, because that remote and extensive country is now a desert, and, secondly, because it appears to be the native locality of the horse, which is the least aquatic of all the Pachydermata. In Europe there are, however, the remains of not fewer than four species, varying so much in size that we may suppose them to have been adapted for rivers of all magnitudes, from the wide sweeping flood to the small brook; and these are not confined to one locality, but found in Italy, in Germany, in France, and in England. That they have not been met with in other places, where the geological character of the country indicates that the animals could have resided, arises more from the want of observation than from any thing else. The observation is no doubt a matter of great difficulty, for no human industry can search the ten thousandth part of the matter deposited even in one extensive valley; then what can be hoped in the case of what have obviously been the general sepulchres of nature for thousands of years.

The great fossil hippopotamus has been found in the clay deposits of many countries, as, for instance, in the valley of the Arno in Italy, in the south of France, near Paris, at Kirkdale in Yorkshire, and at Brentford, in the valley of the Thames, so that it must have been a very general inhabitant of Europe; and Europe must then, in the characters of its waters, have resembled what Africa is now, in those places where the hippopotamus is found in the living state.

Climate, at least so far as depends upon temperature, does not form any necessary or important part of this great question; for as we have the actual fact of an elephant having existed in the extreme north, with a covering better fitted for protecting it from snow and cold than that of any animal now living, while in its anatomy, and therefore by inference in its mode of life, it did not differ much from the elephant, as now found in Asia and Africa, we have no reason to doubt that the other large pachydermata of the north, which are also extinct, were equally adapted to a climate even more rigorous than that of the places where their bones are found at the present day. There are some indications in the form of the fossil skeletons, especially in the parts fitted for motion, which would lead us to suppose that those hippopotami of ancient days were more active than their congeners of the present time. There is more strength in the heads of the bones, as well as more length; and both of these indicate that the muscles were more powerful; the teeth are also stronger, and there are some differences in the cranial bone, which perhaps warrant us in concluding that the animals had more resources.

What the state of the earth was when the hippopotamus was common in Europe, we cannot tell, and shall never, in all probability, arrive at in a satisfactory manner. But we have no reason to believe that the axis of the earth's rotation had a different position from what it has at present; and though the obliquity of its orbit varies, the variation is slow, and is understood to act on their limits, or to involve in itself the means of a return to the same angle after a very long period of years. Hence we cannot suppose that the seasonal action of the sun was very different then from what it is now; for the notion, which has been at different times altered of the stroke of a comet, or some such imaginary cause, tilting the axis of the earth from the perpendicular, is not only gratuitous, but absurd. We have no reason to believe that the earth would be very much affected by a comet, even though it were to pass through one, as the satellites of Jupiter were not in the least disturbed by a comet which got within their sphere of action. Besides, the motion of the earth on its axis is not in any way affected by any body in the heavens, or by any known quality or circumstance of the earth itself. We can see no reason why it should be different now from what it was at the moment of the earth's creation, or why it should become different at any future time of the earth's duration, even if all the rest of the solar system were destroyed, and the earth stood still in its orbit.

In contemplating our own country and latitude as being inhabited by these great pachydermata, which are now found only in the southern parts of the old continent, we must therefore assume, that the annual action of the sun upon the earth must have been nearly the same as it is now. That the earth in our latitudes must have been more humid, and covered with a ranker and ruder vegetation in the

days of those pachydermata than it is now is perfectly obvious; inasmuch as such animals are found only in places where there is a rank vegetation. Water and vegetables are much less affected by changes of temperature than the solid and inorganic parts of the earth, and therefore we may presume that, in these former times, there was much greater uniformity of the seasons—a different vegetation certainly, but one which underwent less marked seasonal changes. The true ferns, and other plants analogous in many of their characters to those that are now met with only in the warm latitudes, prove this. But the very same circumstances must have tended to prevent that drain of heat from the polar latitudes to the equatorial ones which certainly now takes place; for much of the action of the sun goes off to the atmosphere by radiation, and as the air on the surface upon which this radiation of heat chiefly tells, is always creeping toward the equator, it must follow that the cold latitudes are cooled by this means, and that they are more cooled in proportion as the equatorial parts are more converted into desert. This inquiry is a most tempting one, and if we pay even the very slightest attention to these remains of the old world which we meet with at every step, we can hardly avoid entering upon it; but the links in the chain of evidence are so broken that, in the meantime, it is little else than a pleasing dream. The labour of many hands, and the wisdom of many heads, will still be required before the subject is so well explained as to bring it within the limits of popular science.

The middle-sized hippopotamus is the next of the fossil species in point of size, and it, as well as the smaller ones, seems to be wholly extinct, nor have any vestiges of it been found in those parts of the world which the living hippopotamus inhabits. This species, of which the remains have, we believe, been hitherto found in France only, seems to have been about the size of the common hog, and as this is found in the calcareous tufa, which, though a fresh water formation, is in all probability older than the debris in which the remains of the larger one are found, we may perhaps conclude that it became extinct at an earlier period of the earth's history. Only mutilated fragments of the skeleton of this animal have been found; but still there are enough to show that it was a hippopotamus, though different in some respects both from the larger fossil one, and from that which still exists in the living state.

The small fossil hippopotamus has been found in greater abundance than the last species. It has been found in the lower valley of the Garonne, and the flats between the estuary of that river and the Pyrenees, in accumulations of bones at Gibraltar (the whole rock there is, in fact, curious in this respect), in Dalmatia, and in some other places. It is less than the common hog; and the worn state of the teeth shows that it is not the young of any animal. The tusks are crooked, rather more so perhaps than in the living rhinoceros; but still their shape and curvature are quite different from those of any species of hog; the jaws are rather larger, and the muzzle not so broad as in the living species. What effect these differences may have had in modifying the habits of the animal, we are unable to tell; but the general structure clearly shows that it belongs to the hippopotami genus.

The least fossil hippopotamus is less than either of the former. The remains indicate an animal about the

same size as that small and very short-legged variety of the common hog, which was first introduced into Europe from the east of Asia, and is usually called the Chinese breed, though we believe it came at first from countries more southerly than China. The remains of this species have hitherto been found in France only, but we have no reason to suppose that they were confined to that country, only it so happens that the animal remains of France have been examined with more attention than those of most other countries.

Such is a slight notice of all the leading points that are known respecting one of the most singular genera in the whole class of mammalia. They are animals highly interesting in themselves from their very singular mode of life, the powerful manner in which they are armed, and the labours which they perform in the general system and economy of nature. But to those who wish to study the progressive history of the world, and read in a known language those wonderful memorials of former times which are buried in so many places of the earth, they are of still greater importance. We find the living hippopotamus more confined in the range of its pasture, and thus more exclusively fitted for that pasture, than any other animal; and when we examine what that pasture is, we are in so far enabled to judge of what must have been the state of the world when the hippopotamus was a more general inhabitant.

HIRTELLA (Wildenow). A genus of West India trees, so called, from the extreme hairiness of the young shoots. The flowers are pentandrious, and belong to the natural order *Chrysobalanaceæ*.

HIRUNDO (Swallow, or *Hirudinidæ*, the Swallow tribe). A well defined family of birds, belonging to Cuvier's *fissirostral* sub-order of *Passeres*. Several of the species are well known to every body from their familiarity in coming close to human dwellings, their labour in the building of their nests, and their rapid and graceful motions on the wing. In temperate latitudes they are all migrants, marking the beginning of the summer by their coming, and giving notice that it is over by their departure. On these excursions they are generally very true to the season; but a stray one is sometimes tempted to visit the warmer latitudes before our spring storms, and suffers for its temerity. Hence the proverb, "One swallow makes no summer," which means that we ought not to found strong hopes upon slender foundations.

Some of the family find the principal part of their food over the surface of the water, for the greater part of the time that they are in their northern or summer haunts; and all of them resort to the surface of the water when they arrive, and most collect in flocks near the waters before they depart. When natural history was but little understood, the reasons of this were not seen, and consequently erroneous ones were alleged. This is one very remarkable instance of the effect of neglecting a caution which we ought never to forget when we reason beyond the facts on the habits of animals, or indeed on any thing connected with the active economy of nature. There is but *one truth* in every case, and *all else* that can be alleged is error, the proportion between which is every possible variety to one; and, therefore, if a conjecture is hazarded without any grounds, it is next to a miracle if that conjecture shall be true. Consequently, if we have no indication or any other clue to guide us to a reason, in any one matter of natural history, or

indeed in any one matter whatever, the chances are infinitude to one, that any reason which we may in our fancy assign shall be the right one.

This proved to be remarkably the case in the matter of the swallow tribe, and so inveterate was the error that naturalists, almost without exception, and the great Linnæus among the rest, fell into it, although it was at variance not only with the common habits of air birds, but with the whole economy of warm-blooded animals. The reason assigned for this first and last appearance of the swallow tribe when seen skimming the surface of the waters was, that they plunged into the head of the stream, where they passed the winter in a dormant state, and then came up again in the spring; and some learned persons alleged that they had seen the ascent from the water with their own eyes, and entered into the details of it with as circumstantial minuteness as if it had been a truth not only within the limits of possibility, which this was not, but substantiated by general evidence to every part of its occurrence. This very strongly shows the danger of speaking, and especially of writing, upon subjects of natural history, without at least some knowledge of physiology and of the general laws and economy of nature; which, by the way is the reason why we have, in this work, which is framed and intended expressly for general readers—that is, for the great body of the people, and not for mere naturalists,—have been, upon every possible occasion, so anxious to blend the physiology and the relation to the rest of nature with the description of every animal.

When the least attention is given to the subject, the absurdity of hybernation under water, in the case of the swallows, becomes very apparent. There is no warm-blooded animal that can so hybernate,—not even the whale or the seal; nor does it appear that they can sleep there, though they, as well as many of the aquatic birds, can sleep floating upon the surface: but we know of no animal that does or can hybernate on the surface of water; and, indeed, to place an animal on the surface of the water would be putting it in a state of peril to which we have no parallel even in nature. It would be at the mercy of winds and waves, and enemies of all kinds, without any means of protection or power of defence; and we may safely say, that it would be wholly inconsistent with the wisdom and goodness of the Creator, that any one race of beings should be thus abandoned to ruin. Still a warm-blooded animal *might* exist though thus cast upon the waters. Under water is another matter, however; and when once any creature has breathed the pure air of heaven as part of the natural functions of its living system, it can no longer bear to be immersed in a flood of the density of water for any length of time.

Swallows moult their feathers between the time of their disappearance in the autumn and their return in the spring; and this is an operation which could not be carried on under the water: besides, there are few birds which hybernate in any way; none, indeed, which do this habitually; for the few that have been got under hedges and in other places of shelter, apparently lifeless, have always been individuals which met with hindrances which their powers were not able to overcome. Even among the mammalia, the species which hybernate are all sluggish in their general action, cold in their system, and slow and limited in their circulation and breathing; for even on the mountain-tops, or the margins of the never-thawing ice

at the extremity of our continents, we do not find such an animal as a hare passing the winter in a dormant state. On the other hand we find that, even in regions near the equator, many of the reptiles which have a cold system and a sluggish circulation remain dormant for part of the year. The necessity of feeding and of breathing, and also the natural heat of many animals, are in proportion to that animal's activity, for the activity is part of the same system as the rest; and as birds feed more and breathe more than mammalia of the same size and weight, they are also more warm in their temperament, and on that account both less fitted for hybernation and less disposed to it.

Flying is the most severe motion which any animal has to perform, because the flying animal has both to bear itself up in the air and to make progress, whereas, in the case of a walking animal, the weight is borne by the ground, and the moment that it ceases to have progressive motion, it begins to be at rest, or in a state of partial repose. But, even when a bird hovers in the air without making any progression in distance, it is not in a state of even partial repose, as it still has to bear itself up in the air, which, in the case of even the lightest bird, and the one whose plumage is the most floeculent and takes the greatest hold on the air, requires a considerable exertion of muscular energy.

The swallow tribe are more completely air birds, and pass more of their time on the wing, than any other birds which inhabit or visit the British islands. Some of them, the swifts for instance, which are the highest flyers, and which get their common name from the rapidity of their flight, are generally sixteen or eighteen hours on the wing every day at that time of the year when they have their broods. During these hours, they cannot, on the average, move over less space than a thousand or twelve hundred miles; and, if we consider the number of loops and doublings which they make, the exertion, upon one of their long days, must be as great as would carry them at least two thousand miles in one day, so that, at the rate of its ordinary motion in hunting for its food in the sky, a swift could fly round the equatorial circumference of the earth in less than two weeks.

This is a degree of exertion with which we have nothing at all comparable in any animal that walks or runs upon the ground. Some of the swiftest of these can move at the rate of fifteen or perhaps twenty miles in the hour; but there is none that could continue this for several hours, or even for one hour, without being exhausted. There is no miracle in the motion of a flying animal, any more than there is in that of the slowest creature which crawls upon the earth. The principle is the same in them all, though differently modified and furnished with different organisations. And this fact of adaptation runs through the whole, that, in proportion to the action must be the means of repairing the waste occasioned by that action; and among these means respiration is one of the chief. When we make an over-exertion in speed, the lungs are the first part of the body upon which the effects of that over-exertion is felt; and we pant for breath long before we feel any weariness of the limbs. The fatigue of moderate exertion long continued is of a different character; it is felt in the muscles of the parts exerted, while there is no uneasy sensation in the lungs; and it is worthy of remark, that the pulse is rendered both

harder and quicker, and therefore the circulation increased, by that rapid exertion which fatigues the lungs, while in the opposite ease, if the pulse does not become slower it becomes more feeble, which equally indicates a diminished circulation.

The motions of the swallow tribe are, as we have said, and as any one may see, very constant and very rapid; and their quantity of respiration and need of food must, according to the general law of nature, correspond. Their labour in flight is even greater in proportion to the rate of their going, than that of more slow-flighted birds. Feathers that take much hold on the air would be the very worst adapted for them, and accordingly all their feathers are firm and smooth; so that the keeping of themselves up is a matter which requires constant exertion. The auxiliary breathing which they have in supplement to the mere action of the lungs (see the article BIRD), no doubt prevents the exhaustion of these organs; but still the action of the whole bird is not the less, and the circulation must be in proportion, otherwise the general law of nature would be at an end, and the living world would become a mere mass of confusion.

All these circumstances show, in the clearest manner, that swallows cannot possibly hibernate under the water, or anywhere else. And why should they? The very same powers which they exert every day are competent to carry them from Britain to Africa between sun and sun; and, when they have this power of shifting their place with the seasons, it would be letting this run to waste to suppose that they should in any manner hibernate. There is another consideration, which, though very obvious to those who attend to such matters, it may not be improper to mention; all the tribe are dark, approaching to black; of that very colour, in short, upon which variations of temperature have the greatest effect; and this must co-operate with the falling off of their food, in sending them from the northern countries when the cold weather begins to set in.

That the swallow tribe should appear over the waters when they first arrive in our latitudes, and resort to the same places before they take their departure for the season, is also quite natural, and what, from the circumstances of the case, we might be prepared to expect. The whole race feed upon winged insects, which they capture while on the wing; and the waters are the places over which insects appear first in the spring, and linger longest in the autumn. In the autumn, however, the insects are not so directly over the water as they are in the spring; for by that time of the year the greater number of those insects which commit their offspring to the waters, have performed that, the final purpose of their brief duration in the winged state, and have ceased to exist.

From their activity, their very general distribution, and the rapidity with which they perform their migrations from country to country, the swallows are a most valuable race of animals; and in all countries they resort to the very places where their services are most required, and perform them in a way which can be followed by no others of the feathered race. The common house-fly, which, though hardly known in wild nature, follows man in all his migrations; and though it too has its use, its powers of multiplication are so great, that if there were not some means of keeping it within bounds, it would be an absolute

pest. It is most abundant where the situation is most rich and warm; and as it is a scavenger, it resorts to those places in greatest numbers which are kept in the worst order. But even where there is the greatest attention paid to cleanliness, the house-fly still makes its appearance; and thus, the house-martin comes along with it and regulates its numbers, by feeding itself and its brood upon the overplus. Many of the other flies which are captured in the upper air by other members of the swallow family, are captured while winging their way for the purpose of depositing their eggs in situations where the grubs would be very injurious to the vegetable crops; and it is probable that, in that soft and mirky weather before rain, during which swallows and swifts are so busy in the upper air, some of those small insects, the larvæ of which are so annoying to cultivation, take to high flight for the same purposes. It is well-known that, were it not for birds of some description or another, and the greater number of those in our latitudes are migrant birds, retiring to other climes in the winter, the vegetable productions of the earth would be destroyed in one season. Against these little creatures man has few direct defences within the range of his arts; and it is on this account that the insect-feeding birds are so very valuable. In the case of the swallow-tribe we cannot decide by actual observation what it is that they capture as they dart along the sky and skim the surface of the pools with so much activity. But their activity, and the fact of their finding their food in situations where no other birds can, are abundant proofs of their use in the economy of nature. Nor should we forget that it appears to be to man that they are more especially useful; for with us at least they do not resort to the wild, cold, and mountainous places, but to those which are rich, thickly inhabited, and in a high state of cultivation. There are many of the more northerly parts of the country where, at a distance varying from five to ten miles from the sea, the surface rises to the height of four or five hundred feet, and the climate is exceedingly cold and bleak. In these places winged insects are few, and there is not one of the swallow-tribe to be seen; but when the steep is descended, though the horizontal distance may not be above a mile or two, insects appear in swarms, and swallows are regular visitants. So are they in the inland villages, which lie between those coast-hills and the central mountains; and they are often found upon the latter at heights exceeding the very summits of the province. The general history of these active and interesting birds is, however, a subject upon which volumes might be written.

The whole of the race are strictly insectivorous, and never destroy any thing that is useful to man, however much they may contribute to the preservation of many things that are valuable. Still in their way they are a kind of birds of prey, answering to the diurnal action of the *accipitres*, though the prey is different.

The general characters of the genus are well marked and easily remembered. They are all very thickly formed in the anterior part of their bodies, so that the whole mass is concentrated on the axis of the wings, and they taper off in beautiful curves toward the posterior extremity. Their wings are long and pointed, and remarkably compact in their texture, so that they can undergo a great deal of fatigue without injury. Their tails are produced, in

general very stiff, and in most of the species very much forked. All the extremities of their apparatus of flight are in fact pointed, and they can turn on these points in a very singular manner, flying horizontally, or on edge, or at any intermediate angle, apparently with equal ease. The power of the tail appears to give them as much facility of ascent and descent as they have rapidity in forward flight; and as their prey is much more minute than that of even the smallest of the diurnal accipitres, they are endowed with corresponding capacities for finding it. They beat the air with more rapidity and grace than the birds of prey do the ground under them; and the smaller ones, which do not fly above the usual range of the short-winged hawks, assail them with great determination when they make their appearance. It is natural to suppose that their sight is very acute. Their feet are very small and feeble as compared with the power of their wings, but they are not walking birds, and rarely if ever feed upon the ground. Some of them have the foot with all the four toes to the front, or rather all so placed that the claws shall press toward the centre of the foot when the joints of the legs are bent. This enables them to hold on upon upright surfaces, to which no other birds can adhere; and they even, as occasion renders it necessary, bring the tail and the wings to act in aid of this. Their bills are flattened, very broad at the base, generally hooked at the top of the upper mandible, and turned up at that of the lower, but they are without any notch, and the sides rarely close for the whole of their length. For the capture of insects they are very efficient bills, but they are not at all adapted for any purpose of hostility against larger animals. Their gape is remarkably wide; and as they are whisking about on the wing catching flies one can often hear the snap of their bills.

They are sometimes arranged into two subdivisions of swallows and swifts, of which the latter are the more lofty flyers, and probably the more characteristic birds; but we shall not go into the minutiae of the systematic arrangement. We shall first notice those that are to be seen in the British islands, and then name one or two of the more remarkable of the foreign ones.

THE CHIMNEY SWALLOW (*H. rustica*). This is the only species which, with us, is called a swallow, the others being either martins or swifts. It is understood to hatch and breed in Africa, probably to the south of the equator, in our winter, which of course answers to the spring in that country, and to perform its great annual moult about the month of February. Soon after this it begins to migrate northward, and arrives in England about the end of April, at which time it is in fine plumage. The birds speedily disperse themselves, reaching the most northerly parts of the country by the end of the month. They form their nests in chimneys, in out-houses, ruins, and the faces of rocks, but not at any very great elevation. They build with mud, and line the nest with feathers, but do not cover it with a dome. The eggs, in one hatch, are not more than four in number, but in the warmer parts of the country they breed twice, the one hatch being able to take to the wing in June, and the other early in September. In more northerly places they breed only once, and the brood are fully fledged in July, or the beginning of August. They generally take their departure about the end of September, but the time varies a

little with the character of the year. They generally breed in considerable numbers in those spots which afford them favourable nesting-places and abundance of food; but they cannot be said to be casual at those times, as each pursues its own prey and retires to its own nest. When, however, the labours of the year are over, and they begin to prepare for their journey, they do associate in considerable numbers, sitting on the house-tops, or skimming over the humid meadows, in which the birds probably at that time, contrary to their usual habit, roost upon the ground.



Swallow.

The general colour of the swallow is black, with reflections of greyish blue; but in this respect they are subject to some variations, for some are so pale that, if colour alone were the criterion, they might be taken for different species, and occasionally, though much more rarely, they are albinos. The throat and forehead are deep reddish brown, and there is a white spot on the inner web of each of the tail-feathers, with the exception of two in the middle, which are the shortest; the lateral tail-feathers are very long, and this gives a remarkably forked appearance to the tail, so much so, that "swallow-tailed" is a common name for any appendage which is divided in this manner at the end. Swallows are very active and interesting little creatures, whisking about over the surface of the pools, and in other situations where winged insects are numerous, on those days, and at those times of the day, when all the children of nature, except the insect tribes, are still. They glide and dart about with great lightness, and apparently very little motion of the wings, so little indeed, that every single stroke appears to impel them on as if they were shot from a bow. Nor are their turnings on the wing less worthy of remark; for they can double back, not merely at an angle, but at a very acute angle; and though this is done with so much rapidity that one cannot observe the action of the different parts, yet there is a sort of twitching sound, as if some of their fan-feathers struck smartly against each other; but this twitching sound on the turn must not be confounded with the snap of the bill which the bird gives in catching its prey.

THE HOUSE-MARTIN (*H. urbica*). This is perhaps the most interesting to man of the whole swallow tribe; and though the house-sparrow is a much more constant attendant on human dwellings, it is not nearly so interesting as this little periodical visitor. This is the "martlet" of the heralds, and was by them described as footless, or a creature committed to the free air alone, and thus it became emblematic of those

younger branches of families which the most absurd and unwise law of primogeniture cuts off from any share of the paternal estate. It is worthy of remark, as concerns this same law, that there is not the slightest approximation to it on the part of any creature when in a state of nature; and though we are not, of course, to take the example of any animal as our rule of action, yet, when the example, and the voice of universal nature, are against us, we can hardly be right. Every one must remember the beautiful allusion made by the gallant Banquo to the nests of this bird found on the cornices of the castle of his treacherous host; and the reader who chooses to turn to that exquisite passage, will see with what truth the poet has not only described the habits and manners of the bird, but has shown the distinction between it and its congener, the swift, with equal force and truth:—

"This guest of summer,
The temple-haunting martlet, does approve,
By his loved mansionry, that the heaven's breath
Smells wooingly here: no jutting, frieze, buttress,
Nor coigne of vantage, but this bird hath made
His pendent bed and procreant cradle: where they
Most breed and haunt, I have observed, the air is delicate."

Nothing can be more graphic than this; for we have observed that, in those uplands of the north, which do not deserve the name of mountains, or even of hills, but which often consist of a species of clay-gravel, which is perfectly sterile, and in which the stones are so impregnated with the cold salt of iron, that they literally consume the earth around them, as if every stone were a canker—we have been in the habit of observing, in such places, that there is not a single swallow to be found; but if some clear stream, with alternate banks of dry sand and soft green sward, breaks the monotony of such a desert, and if the lively "clack" of a mill, as is generally the case, is heard, then the windows of the miller's house have their swallow's nest in each corner, and may be seen whisking across the mill-pond and along the stream with so much industry and glee, that one feels, or, which comes to the same thing, fancies—that a remarkable transition from the most chilling to the most balmy atmosphere has been made in less than a single furlong of ground. Nor is the distinction between the swallow and the swift less true to nature. The latter birds couple on the wing, and perform their rites in the air; but the nest—"the pendent bed and procreant cradle"—is the place where the swallow performs all the labours of the season. The most wonderful circumstance connected with those allusions is their perfect truth, at a time when books written professedly on natural history, by men who assumed the character of naturalists, were full of gross and palpable absurdities; and those exquisite touches of nature which this foremost of all poets throws into his works, and throws in with apparently no effort on his part, are given by him as truths well known to those whose occupation cannot be considered as favourable to the professional study of natural history. Banquo, who makes these beautifully philosophical remarks on the house-swallow, was a brave and gallant soldier, but nothing else.

The house-martin finds out the abode of man in almost every part of the world, at least in every part where it has a chance of finding food for itself and its young; and it is rarely found amid places which are deserted and in ruins. It is probable that

the great attraction for it is the house-fly, for that fly is found only in the neighbourhood of houses, and is rare, indeed, even in those wild woods where winged insects abound the most. It is astonishing to what an extent so small a creature as this house-fly plays the scavenger, and reproves, by the countless swarms in which it appears in houses toward the latter part of the year, the slovenliness of those to whom the charge of such houses is committed. The house-martin is not quite so dashing a bird as the chimney-swallow; its wings are rather shorter and less pointed, and the external feathers of its tail are not so much produced. Still the house-martin is the prettiest bird of the two, and its familiarity makes it an especial favourite. The whole of the upper part, with the exception of the rump, is black, brownish-black on the tail-feathers and the quills and coverts of the wings, and bluish-black on the rest of the body. All the under part is white, of a very pure tint, and the feathers on the sides of the neck break finely into each other. The chief difference between the sexes is, that the breast of the female has a slight greyish tinge, while that of the male is pure white. The tarsi and toes are covered with whitish down, but in no very great quantity.



Martin.

The house-martin is not only the most familiar of our swallows, but it is also the first to reach us in the spring, and the last to leave us in the autumn. As the whole race comes from southern climates, returning to those climates again when the season which is favourable to their habits in our country is over, they appear first and last in the more southerly places; but still they are not long in distributing themselves over the country; and it is highly probable that the greater number of them frequent the same breeding-places for a number of years. If they can build under a projection, which will keep the rain out of their nests, they prefer such a situation; but if not, then they construct a dome to the nest. Those nests are often in curious places. White mentions one which was built in the wing of an owl which had been nailed to a barn; and Jesse mentions one which had not only constructed its nest, but performed its incubations and reared its brood, on the knocker of the hall-door at a gentleman's house in Warwickshire. When the door was opened the bird quitted the nest

for a little, but returned when the door was closed. The winning ways of house-martins, their attention to each other and to their young, and their neat appearance, all tend to render them great favourites; and we believe that, in those parts of the country where there is any feeling of nature among the people, the schoolboys would be considered as acting as sacrilegious a part, in destroying the nest of a house-martin, as in plundering that of a sky-lark, whose glorious matin-song charms even the rustic into feelings of respect and gratitude.

The structure of this swallow's nest is well known. It is formed of mud worked with moisture, much in the same way as the mud walls of cottages in some countries, or as that combination of mould which engineers use for "puddling," or rendering water-tight the banks and bottoms of canals in porous soils. This structure being usually formed in the dry and warm weather, and applied in small quantities, so that each layer consolidates before a fresh one is applied; the texture is very firm and compact, and very nearly impenetrable by water, and insoluble in it. This is also the character of those walls which are constructed wholly of loam or mould, in the manner which is called building *en pise* in some parts of France; for these are more dry and durable than walls of stone or brick.

Some have alleged that there are certain glands in the stomach of those swallows which build compact nests, either of mud, as is done by the species under consideration, or of gelatinous matter, as is done by some others hereafter to be described, which secrete a glutinous substance that assists in giving firmness to the nest; but the nests of common swallows do not contain a trace of any such matter in their composition; and it is very improbable that there is any such matter furnished by the stomachs of those species which construct the gelatinous nests. It is true that we are not very well informed as to what the substance is of which those nests are constructed; and it is also true that there are peculiar glands in the stomachs of those swallows, of which, owing to our ignorance of the general habits of the birds, we do not know the use; but though we are ignorant of the particular matter of which the nests are formed, and also of the particular uses of those glands, it is not a very philosophical proceeding to apply our ignorance of one matter as an explanation of our ignorance of another; and yet this has often been resorted to and been exulted in as something of no common scientific depth by men of high name in comparative anatomy and animal physiology.

The safest way of avoiding such blunders as these, or if they deserve a gentler epithet, such *per saltum* conclusions, which fairly leap across the dark place without throwing any light upon it, is to have recourse to the general analogy of nature, and see whether that would be violated by our supposed discovery. Now we are not aware that there is any warm-blooded animal which elaborates any substance in glands or any other apparatus in the stomach, for any purpose saving the preparation of food either for itself or for its young; which last is understood to be, in part at least, the case with the stomachs of pigeons; nor is it in warm-blooded animals only that we find the stomach confined to the single function of nutrition; for in those invertebrated animals which elaborate shells, and spin threads, and weave webs, and form so many other curious structures, we always find that there is a distinct and specific structure, or apparatus

in the animal, specially adapted for this purpose, and having nothing to do with its digestive system; but requiring a process of secretion in addition to that of assimilation. We mention this circumstance in order to caution the reader against being carried away by that analogy of double ignorance, which is more frequently a stumbling-block than many would be apt to suppose. That we are equally ignorant of two subjects constitutes a certain sort of resemblance between them in our apprehension, but it is not a resemblance from which any conclusion can be drawn.

House-martins are very industrious little creatures; and in those parts of the country which are best adapted to them, they are understood to rear three broods in the course of the season; one in May, a second in June, and a third in July. The hatches do not exceed four or five in number, and each incubation lasts about fifteen days. In the intervals the house-sparrows sometimes take possession of the martins' nests; and though the martins are unable to expel the intruders, it is said that they sometimes build them in.

THE SAND MARTIN (*H. riparia*.) Is the smallest of our British swallows; and it is shorter in the wings and less dark in the colour than those which have been mentioned. Its style of flight is probably as continuous as that of any of the others, if we except the swift, but it is not so bold or discursive. The sand-martin, or bank-swallow as it is called, is brownish black on the upper part and the breast, but white on the remainder of the lower part, and also on the chin and upper neck; upon which latter the white forms a collar nearly halfway round.

This species arrives at least as early as any of the others, and is as late in quitting the country; but it differs from them in the places to which it resorts, and also in its habits. It does not necessarily come near the abodes of men, though if such ground is suitable for its purpose, it is by no means a timid bird; and it is by no means uncommon to find the house-martin very abundantly all over a village, and the sand-martin as plentiful in the sides of a steep bank at the entrance of the village.

In constructing of their nests, sand-martins are excavators, not builders; and they choose the bold and abrupt faces of banks, where the soil is dry and not over-hard, but where it is not likely to be decomposed or washed away by the rain. Firm sand appears to suit them better than any thing else; and where a road has been cut to a considerable depth through a sandy knoll, martins generally find it out and drill it in holes for their nests. Such places are also in general warm, and abound with flies, so that the birds have plenty of food; but under equal circumstances, they prefer the vicinity of water, over the surface of which they are very industrious.

When a colony first take possession of a new bank which has been opened to them, the scene is a busy and far from an uninteresting one. They attack it with mattock and shovel, the bill answering for the first and the claws for the last. The pair work incessantly at this excavation; but as the entrance is not larger than to admit one bird, they do not work in company but by turns, the one carrying on the excavation while the other is feeding. As they labour hard, and live upon small prey which they catch on the wing, their life is a busy one. But still the alternation of digging and feeding appears to afford them considerable relief, as different parts of the body come

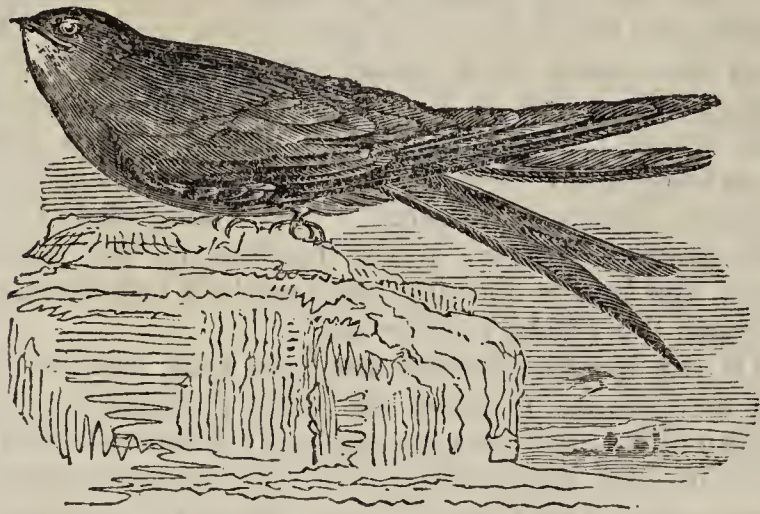
into their most severe action during the two tasks. The excavation for the nest is often made to a considerable depth into the bank; and, as is the case with all birds which mine into deep banks, the entrance is made sloping upwards, so as to render the entrance of wet impossible. After the birds have excavated these nesting places to the necessary depth, they line the interior with vegetable fibres and feathers; but as they have more natural shelter from the depth of the excavation, which is often as much as three feet, they are not so careful in lining the nest as those species are which breed in more open places. The eggs are rather more numerous than those of the house-martin; but it is probable that the incubation lasts longer; and it is certain that the birds take more time before they are fledged; and there are not so many broods in the year. The young birds have rust-coloured margins to the feathers on the upper part; and in this marking, the female is intermediate between the young and the male.

Of the *hirundines* which we have now mentioned, the martins are perhaps the most characteristic as British birds; and they are probably more exclusively birds of that migration which takes place between Europe and Africa, nearly in the line of the meridian, than any others of the genus; for though birds of this genus are found in almost every part of the world, north or south, most of them have more the character of our swallows than of our martins. These foreign species are so numerous, their habits are so little known, and those which are known, in general agree so closely with those of the species with which we are familiar, that we must confine ourselves to mere notices of a few of the more remarkable; and before we do so we shall advert to the swifts, as British birds, which, though very closely resembling the swallows and martins in their general habits, have sometimes been arranged and described as a separate genus under the name *Cypselus*.

THE COMMON SWIFT (*C. apus*). Though not altogether footless, as the epithet *apus* would lead us to suppose, is yet worse supplied in feet available to any purposes of locomotion, than perhaps any other British bird. It is true that some of the aquatic birds are as ill adapted for walking as the swift is; but then their feet are all swimming feet, and thus adapted for motion of another kind, and the reason of their answering so ill for the common purpose of walking is chiefly or entirely their superior adaptation to that of swimming. The swift, on the other hand, is no swimmer, and though it partakes in so far of the habit of the race generally as to be able to strike the surface of the water as it darts along on the wing, yet even this habit is not nearly so strong in it as in the swallows properly so called. The foot of the swift is remarkably short, with all the toes turned forwards, and the tips of the claws directed toward the centre of the foot; it is thus a perching foot, but it is adapted for sticking to the asperities of upright rocks and walls, in which the bird is greatly assisted by the great length of the wings and the tail, and the peculiar structure of each, which consist of very fine feathers successively overlapping each other, so as to give great stiffness to the part, at the same time that it is comparatively light.

Of all our birds, the swift may be said to be the most lofty inhabitant of the sky, and the one which is most constantly upon the wing, and its structure corresponds with this habit, for our swift is our best

winged bird in proportion to its size. The weight of the swift is about an ounce; its length nearly eight inches; its breadth about eighteen. The bill is black; irides dusky; with the exception of the chin, the whole of the plumage is black, the chin being whitish. The wings are extremely large, and the legs so short that it rises from the ground with difficulty; the legs and toes are black, and the tail forked. The foot is the principal structural character in which the swift differs from the swallows.



Swift.

When we state that the swift is the loftiest inhabitant of the sky, we do not mean to say that it rises higher than many other birds when migrating or even when beating about for their prey, but the swift feeds in the upper air, and is the only bird which habitually does so. The swallows feed lower down, and the nocturnal birds, which catch insects on the wing, feed lower still; but when we find swifts particularly on the alert in their peculiar style of insect-catching, they are always driving along and wheeling and screeching at the very top of the sky. Of course swifts are confined to places that are fertile and comparatively low, because it is in such places only that a sufficient supply of insect food is found for any of the race; and it would be useless to suppose that any bird could procure a living in the thin air over the mountain tops; but still we can observe that beautiful gradation in the structure, the habits, and the haunts of the swifts, which is traceable in all the swallow tribe. Of our species the sand-martin is the weakest in the body and the least powerful on the wing, and it builds in holes of the earth, and flies low over the surface of water and over ground which abounds in winged insects, which rise during the day, but not to any considerable height. The house-martin comes next in order, building in the angles of windows, or in the eaves of houses, and rarely getting much above house-height in its ordinary flying. The swallow builds in the chimney, is better winged than the martin, has the tail more forked, and can pursue a bolder flight; and accordingly we find it flying higher and straining more vigorously on the wing than either of the martins. The swift nestles above house-height, in the crevices of steeples and towers, and the crannies of rocks, where it constructs its nest wholly of vegetable matter and feathers, without any attempt at mud building. Though the swift is better formed for activity than any of our other summer birds, and is in reality more active, the smaller number of its brood shows that the place which nature assigns it is on the very confines of that chill atmosphere in which no living creature can sub-

sist. The eggs are rarely, if ever, more than two in number, of a white colour, and considerably elongated. The female is a close sitter, and while she is on the nest the male bird hunts very industriously in the neighbourhood, and is ever and anon serenading her with his harsh and discordant screech. At night the two birds are housed in the same crevice; but whether the male actually takes a share in the labour of incubation has not been very clearly ascertained.

The height to which swifts fly depends a good deal upon the state of the weather. When the atmosphere is pure and dry their flight is most elevated, but when it is moist they fly much lower, and sometimes come down so far as almost to touch the surface of the water. In those troubled states of the atmosphere which usually precede thunder-storms in our warm months, they are more active than at other times, and also more varied in the elevation of their flight. They seldom, if ever, alight on level ground, because their short legs and long wings would make rising from such surfaces a matter of considerable difficulty. The swift is among the last of our swallows in coming, and it is also the first to depart; and this shows that the place where they feed is the one which is the latest in producing, and the first which ceases to be productive. The quantity of their motion during the summer days is immense, for they are often sixteen hours not only on the wing but in vigorous and continued flight, during which time they travel over as many hundreds of miles as they fly hours. Such a rate of flight, and power of continuance on it, renders migration a very simple matter with the swifts, and it is not too much to say that they breakfast in Africa and roost in England on their arrival, or breakfast in England and roost in Africa when they take their departure.

WHITE-BELLIED SWIFT (*C. alpinus*). This species, which is of comparatively recent observation as a British bird, and has hitherto been noticed only as a straggler in the south-east of the island, differs in colour, in size, and in some other particulars from the common swift. With us the common swift is deep black, with only the chin dull white, though the black becomes brownish toward the close of the season. The Alpine swift is brownish on the upper part, and has the belly white. It is also a larger bird, being about nine inches long. It has the bill black, the feet flesh-coloured, the sides mottled with a dusky colour and white, and a brownish grey collar on the neck.

Though a rare straggler in our island, the white-bellied swift is a very fine bird, and perhaps has more "dash" about it than the species with which we are more familiar. Like the other, it is a migrant, but its migrations are of a more southerly and easterly character. Its range is from an indefinite distance, southward, in Africa, to the average line of the Alps, though we believe it is by no means common northward of the summits of those mountains, excepting in the Tyrol, where it is said to range farther to the north than in more westerly longitudes. In coming and going it is found in considerable numbers in the islands of the Mediterranean, and on the coast of Italy; but these are not its proper habitats. It arrives in Upper Lombardy and the adjacent countries about the beginning of April; but its first haunt is over the pools and marshes, so that even this bird might have been described as hybernating in the water, with as much propriety as our common swallow. It remains

over those lowland and marshy places for about a fortnight or three weeks, after which it betakes itself to the mountains and begins in earnest its labours for the year. It nestles in the clefts of rocks which stand high and beetling in mid air, among which it dives about with great vigour and rapidity, wheeling and sporting as if it were wholly composed of wings, though its little crab feet are always in readiness to clutch and maintain their hold on the least irregularity of the rock, whenever they require a pause in their aerial motions. They usually fly in society, not in very great numbers; but there are some curious instances of consent among them; for while one clings to the rock, a second clings to the first, a third to the second, and so on, till the whole form a sort of chain of birds moving in the air. What may be the reason of this singular mode of clinging to each other it may be difficult to say, but it must be momentary, as the birds remain but a very short time in this posture before they are wheeling and screaming with the same activity as before. Such of them as nestle in the Appenines appear earlier in the season, and set about the construction of their nests. Those nests are small for the size of the birds, but they are carefully put together and carefully lined with soft feathers. In those sontherly places they have two broods in the season; the first, consisting of three or four, being matured about the middle of July; and the second, consisting of two only, about the end of September. Those which resort to more upland and northerly places are said to have only one brood in the year, consisting of two eggs, as is the case with our swift. In October they usually take their departure for more southern climates; but they are not so constant in their time of departure as in that of their arrival. The Italians, who are much more given to eat small birds than we of a land more abundant in beef and mutton, esteem the young of these swifts as delicacies for the table; but after their muscles have been seasoned to the sky by a journey to Africa and back again, they, like the muscles of all other birds inured to vigorous and continued flight, become somewhat tough for mastication.

When these birds retire to rest after the severe labours of the day, the male and female squat down together upon the nest; and when they do so they may be touched, or even taken, with the hand. The precise range of this species in longitude is not very well known; but it is not at all improbable that they may reach as far as the east of Asia, or even to the oriental islands; for there are several species in those parts of the world whose characters are not very well ascertained; though it should seem that some of them, at least, bear a considerable resemblance to this species. It should seem, however, that the long-winged swift (*C. longipennis*) is a distinct species. It has the upper part of a bright dark-green colour, with the wings and tail of a bluish green, except the quills next the body, which are white. There is a spot of maroon brown on the ear coverts, and the under part of the neck is ash-coloured, with the exception of the middle of the belly, and the under tail coverts, which are white. The rump is greenish ash, the bill black, and the feet reddish. The male is without the spot on the ear coverts. The length of the head is between eight and nine inches.

THE GREAT CHINESE SWIFT (*C. Sinensis*) is another oriental species, having some points of resemblance to the white-billed swift of southern Europe;

but it is larger in size, and differently coloured. It is brown on the upper part, with the top of the head bright russet, a brown band across the eyes, surrounded with small white feathers. The bill and feet are bluish grey; and the length about eleven inches and a half.

THE RUFFED SWIFT (*C. comatus*) is an inhabitant of the oriental islands. The upper parts, the neck, the breast, and the belly, are bronze green; the sides of the head are furnished with long and straight feathers of a white colour, which form a sort of hood over the base of the bill, and also a kind of crest on the nape. The feathers on the other parts of the head are also long and pendent, and they are bronze green. The quills and tail feathers are bright green with metallic reflections; the belly and the under tail coverts are white; and the bill and feet are blackish. The tail is very much forked. It is a beautiful species, but it is small, the length being little more than five inches and a half. The habits and migrations of these southern species are little known; and some of them have, in all probability, been confounded with the swallows, from which, however, the real swifts can always be easily distinguished by the shortness and peculiar form of their feet, and the elevation and style of their flight.

THE GREAT SWIFT (*C. giganteus*) is a native of Java, and most probably of several other south-eastern isles. It is nearly eight inches in length; the general colour of the upper part is blackish brown, with the exception of the middle of the back and the scapulars, which are ash-colour without any reflections or gloss. The top of the head, the nape part of the coverts of the wings, and also of the under tail coverts, are of a deep green with very brilliant reflections; the greater coverts and quills of the wings are black with brilliant reflections; and some of the quills have the point and the shaft prolonged, and without webs for some part of their length. There is a white band on the thighs, and the tail feathers also are in part white. The bill and feet are brown. The eastern islands are, indeed, very favourable pastures for fissirostral birds, because the air over them swarms so thickly with insects; and though some of the species are migrant in that garden of the world as well as in our more seasonal country, they are, taking them on the whole, much more resident; and though it is difficult to say which are the more characteristic birds in a country so abounding in birds, and so curious as well as brilliant in some of the species, yet the Sunda Islands appear to be especially the head-quarters of the swifts, which are the most rapid and elevated flyers of all insectivorous birds which seek their food on the wing. Whether any of the swifts, properly so called, visit New Holland, has not been so clearly made out; but there are some swallows in that part of the country, though in several respects they differ from ours. The principal one which seasonally visits the east coast of New Holland, is,—

THE JAVA SWALLOW (*H. Javanica*); and we cannot perhaps do better than quote the following account of it from Cayley, as communicated to the Linnæan Society by Vigors and Horsfield:—"The resting-places of these swallows are on the dead boughs of large trees, where I have seen several of them gathered together in the same manner as European swallows on the roof of a house. I apprehend, however, that it is when their young have taken to flight that this occurs.

"The earliest period of the year that I noticed the appearance of swallows was on the 12th of July, 1803, when I saw two; but I remarked several towards the end of the same month, the following year (1804). The latest period I observed them was on the 30th of May, 1806, when a number of them were twittering and flying high in the air. When I have missed them at Paramatta I have sometimes met with them among the North Rocks, a romantic spot about two miles northward of the former place. The natives call the swallow *Berrin-rin*; they told me it built its nest in the hollow limbs of white gum-trees, using bark, grass, hair, or similar substances; but when it built in old houses, it made use of mud. These old houses are the deserted huts of settlers who have abandoned their worn-out farms; and the nests are constructed on the wall-plates, as they are called in the colony. Of the nests, which have been brought to me, I have observed that the outside was made of mud, and the inside lined with feathers. Though I have seen swallows more or less throughout the year, yet it is my belief that they are migratory. The eyes are black."

The American species, as we have already remarked, are swallows or martins, rather than swifts; and though in their habits they bear a very close resemblance to the species of the eastern continent, and some of them get similar names from the European settlers, it is doubtful whether any of them are exactly the same species. They are very numerous in some parts of the country, and they follow the common seasonal migration of American birds, proceeding northwards in the spring, and returning southward in the summer.

THE AMERICAN CHIMNEY SWALLOW (*H. pelagio*), though sometimes called a swift in the United States, very closely resembles our chimney swallow in some of its characters; but it is rather a smaller bird, and remarkable for the length of its wings, the stretch of which when spread out is twelve inches, while the length is only about four and a half. The sexes very closely resemble each other in colour, being sooty brown, with the exception of the chin, and a streak over the eyes, which are dull white. The naked skin from the bill to the eye is black; the bill is extremely short, hard, and black; the nostrils are placed in a slightly elevated membrane; the legs are covered with a loose skin of a purplish colour, the thighs are of the same colour and naked; the feet are very muscular; the three fore toes are very nearly of the same length; the claws extremely sharp; when the wing is closed it extends an inch and a half beyond the tip of the tail, which is rounded, and consists of ten feathers very little longer than the coverts; their shafts extend beyond the vanes, they are strong, sharp-pointed, and extremely elastic.

The following quotation from Wilson's account of this species will show the habits of this bird, and also what are the resources of chimney-building swallows where the country contains no chimneys in which they can build. "One of the first settlers in the state of Kentucky," says Wilson, "informed me that he cut down a large hollow beech tree, which contained forty or fifty nests of the chimney swallow, most of which, by the fall of the tree or by the weather, were lying at the bottom of the hollow, but sufficient fragments remained adhering to the sides of the tree to enable him to number them. They appeared, he said, to be of many years' standing. The present site which they

have chosen must, however, hold out many more advantages than the former, since we see that, in the whole thickly settled parts of the United States, these birds have uniformly adopted this new convenience, not a single pair being observed to prefer the woods. Security from birds of prey and other animals, from storms that frequently overthrow the timber, and the numerous ready conveniences which these new situations afford, are doubtless some of the advantages. The choice they have made certainly bespeaks something more than mere unreasoning instinct, and does honour to their discernment. The nest of this bird is of singular construction, being formed of very small twigs, fastened together with a strong adhesive glue or gum which is secreted by two glands, one on each side of the hind head, and mixes with the saliva. With this glue, which becomes hard as the twigs themselves, the whole nest is thickly besmeared. The nest itself is small and shallow, and attached by one side or edge to the wall, and it is totally destitute of the soft lining with which the others are so plentifully supplied. The eggs are generally four, and white. They generally have two broods in the season. The young are fed at intervals during the greater part of the night, a fact which I have had frequent opportunities of remarking both here and in the Mississippi territory. The noise which the old ones make in passing up and down the funnel has some resemblance to distant thunder. When heavy and long continued rains occur, the nest, losing its hold, is precipitated to the bottom; this disaster frequently happens; the eggs are destroyed, but the young, though blind (which they are for a considerable time), sometimes scramble up along the vent, to which they cling like squirrels, the muscularity of their feet and the sharpness of their claws at this tender age being remarkable. In this situation they continue to be fed for perhaps a week or more. Nay, it is not uncommon for them voluntarily to leave the nest long before they are able to fly, and to fix themselves on the wall, where they are fed until able to hunt for themselves. When these birds first arrive in spring, and for a considerable time after, they associate together every evening in one general rendezvous, those of a whole district roosting together. This place of repose, in the more unsettled parts of the country, is usually a large hollow tree, open at top; trees of that kind, or *swallow trees*, as they are usually called, having been noticed in various parts of the country, and generally believed to be the winter quarters of these birds, where, heaps upon heaps, they dozed away the winter in a state of torpidity; here they have been seen on their resurrection in spring, and here they have again been remarked descending to their death-like sleep in autumn."

PURPLE MARTIN (*H. purpurea*). This is also an American species, and in its manners it bears no inconsiderable resemblance to the house-martin of Europe, frequenting, like that bird, the habitation of man in preference to more lonely and sequestered places. It is very abundant in the United States; and a solitary instance of dislike to it, recorded by Wilson, is so characteristic, that we cannot resist quoting it. "I never met," says he, "with more than one man who disliked the martins, and would not permit them to settle about his house. This was a penurious close-fisted German, who hated them because, as he said, 'they ate his peas.' I told him he must certainly be mistaken, as I never knew an instance of martins eating peas; but he replied, with

coolness, that he had many times seen them himself 'blaying near the hife, and going *schnip schnaup*,' by which I understood that it was his *bees* that had been the sufferers; and the charge could not be denied."

In general, however, the Americans are sensible of the advantages which they derive from these birds in clearing the neighbourhood of their houses of winged insects, which are particularly troublesome in that land of marshes and forests. They arrive in the southern states in February or March, but do not reach the central ones till March or April; and in more northerly places, for their migration extends nearly to the polar confines of the American continent, they arrive in May, and take their departure in August. The ornithologist, to whom we are under such obligations on the subject of all such birds in America as come within his notice, has so well described the accommodations that are made for those interesting little creatures, that we should do them injustice were we to mention them in any words except his own. "The summer residence," says Wilson, "of this agreeable bird is universally among the habitations of man, who, having no interest in his destruction, and deriving considerable advantage, as well as amusement, from his company, is generally his friend and protector. Wherever he comes he finds some hospitable retreat fitted up for his accommodation and that of his young, either in the projecting wooden cornice, on the top of the roof, or signpost, in the box appropriated to the bluebird, or, if all those be wanting, in the dove-house among the pigeons. In this last case he sometimes takes possession of one quarter or tier of the premises, in which not a pigeon dare for a moment set its foot. Some people have large conveniences formed for the martins, with many apartments, which are usually fully tenanted, and occupied regularly every spring, and in such places particular individuals have been noted to return to the same box for several successive years. Even the solitary Indian seems to have a particular respect for this bird. The Choetaws and Chickasaws cut off all the top branches from a sapling near their cabins, leaving the prongs a foot or two in length, on each of which they hang a gourd or calabash, properly hollowed out for their convenience. On the banks of the Mississippi the negroes stick up long canes, with the same species of apartment fixed to their tops, in which the martins regularly breed. Wherever I have travelled in this country I have seen, with pleasure, the hospitality of the inhabitants to this favourite bird."—"About the middle, or 20th of April, the martins first begin to prepare their nest. The last of these which I examined was formed of dry leaves of the weeping willow, slender straw, hay, and feathers in considerable quantity. The eggs were four, very small for the size of the bird, and pure white, without any spots. The first brood appears in May, and the second late in July. During the period in which the female is laying, and before she commences incubation, they are both from home the greater part of the day. When the female is sitting she is frequently visited by the male, who also occupies her place while she takes a short recreation abroad. He also often passes a quarter of an hour in the apartment beside her, and has become quite domesticated since her confinement. He sits on the outside, dressing and arranging his plumage, occasionally passing to the door of the apartment, as if to inquire how she does. His notes, at this time, seem

to have assumed a peculiar softness, and his gratulations are expressive of much tenderness. Conjugal fidelity, even where there is a number together, seems to be faithfully preserved by these birds. On the 25th of May a male and female martin took possession of a box in Mr. Bertram's garden. A day or two after a second female made her appearance, and stayed for several days; but, from the cold reception she met with, being frequently beat off by the male, she finally abandoned the place, and set off, no doubt, to seek a more sociable companion. The purple martin, like his half-cousin, the king-bird, is the terror of crows, hawks, and eagles. These he attacks whenever they make their appearance, and with such vigour and rapidity that they instantly have recourse to flight. So well known is this to the lesser birds, and to the domestic poultry, that, as soon as they hear the martin's voice engaged in fight, all is alarm and consternation. To observe with what spirit and audacity this bird dives and sweeps upon and around the hawk or the eagle is astonishing. He also bestows an occasional bastinado on the king-bird when he finds him too near his premises, though he will, at any time, instantly co-operate with him in attacking the common enemy. The martin differs from all the rest of our swallows in the particular prey which he selects. Wasps, bees, large beetles, particularly those called by the boys *goldsmiths*, seem his favourite game. I have taken four of these large beetles from the stomach of a purple martin, each of which seemed entire, and even unbruised."

This species is very swift in its flight, and wheels and turns with much rapidity and grace. It comes more into the towns of America than the European swallows do into the towns of Europe; and along with its familiarity, the neatness with which it avoids passengers and other objects in the streets, is worthy of admiration. It is rather a large species, being at least eight inches in length, and double that measure in the stretch of the wings. The general colour of the upper part is a rich and deep purplish blue, with very brilliant reflections of violet; but the wings and tail are brownish black. The tail consists of twelve feathers, is considerably forked and margined with purplish blue. The bill is very strong, and the opening of the mouth large; the eye is very full and dark, and surrounded by naked skin of a black colour. The legs are very short, approaching in that character to those of the swifts. The female is of nearly the same dimensions as the male, but it differs a little in colour. The prevailing tint of the upper part is blackish brown, with purple and violet only in scattered spots. The chin and breast are greyish brown; the under sides of the wings of the same colour, but darker; and the belly and vent-feathers are dull white, marked with dusky yellow.

THE BARN SWALLOW (*H. Americana*), is another American species which has a considerable resemblance in its habits to our house swallow. It is a smaller bird, and less powerfully winged than the species last noticed; but it is very abundant, and migratory, appearing in great numbers in the narrow part of central America, especially about Honduras, during the rains which occur between the months of October and February, but as soon as the rains are over, it takes its departure for more northerly climates. Some remarks on the habits of these birds, made by Captain Henderson in his account of Honduras, are worthy of quotation, as pointing out something peculiar in the

habits of birds, in that very singular region of the world. "There is something," says Captain Henderson, "remarkably curious and deserving of notice in the ascent of these birds. As soon as the dawn appears they quit their place of rest, which is usually chosen amid the rushes of some watery savannah, and invariably rise to a certain height in a compact spiral form, and which, at a distance, often occasions them to be taken for an immense column of smoke. This attained, they are then seen separately to disperse in search of food, the occupation of the day. To those who may have had the opportunity of observing the phenomenon of a water-spout, the similarity of evolution in the ascent of these birds will be thought surprisingly striking. The descent, which regularly takes place at sunset, is conducted much in the same way, but with inconceivable rapidity; and the noise which accompanies this can only be compared to the falling of an immense torrent, or rushing of a violent gust of wind. Indeed, to an observer, it seems wonderful that thousands of these birds are not destroyed in being thus propelled to the earth with such irresistible force."

This species of swallow is about seven inches in length, and thirteen inches in the stretch of the wings. The bill is black, the upper part of the head, neck, back, rump, and tail-coverts steel blue, which descends rounding on the breast. The front and chin are of a deep chestnut. The belly, vent, and lining of the wing, light chestnut. The wings and tail are of a brown black, slightly glossed with reflections of green; the tail is forked, the exterior feather on each an inch and a half longer than the next, and tapering towards the extremity; each feather, except the two middle ones, marked on its inner vane with an oblong spot of white; eye dark hazel. The sides of the mouth are yellow, and the legs are dark purple. The female differs from the male in having the belly and vent rufous white, instead of light chestnut. These parts are also slightly clouded with rufous, and the exterior tail feathers are shorter. These birds soon become exceedingly gentle, and are easily tamed; and when kept in a room, they employ themselves in catching flies, and picking them from the garments, &c., it may contain; and they may be occasionally observed calling out of the window to their old companions as they pass it.

These birds are more abundant on the Atlantic side of the Alleghany mountains than they are in the great central valley of North America, and in every place they are more abundant as the country is more thickly settled. They do not frequent the woods and wilds, but rather the close vicinity of the farmhouses, where they make their nest attached to the beams and rafters of barns, and other large out-buildings; and so partial are they to such places, that scarcely an outhouse to which they can find access is without them. Sometimes one large barn will contain several scores of nests, and though the birds build within a few inches of each other, the greatest harmony appears to prevail among them; nor are they subject to the persecution of even the most parsimonious of the German settlers, not being accused of going "*schnip schnaup* near the hif," as is alleged of their congener formerly alluded to. On the other hand, even the superstition of the Germans has come to the protection of these birds; for Wilson found settlers of that country who firmly believed that this kind of swallow protected their barns from lightning, and that if they

wantonly killed the birds the milk of their cows would immediately after become tinged with blood. They build their nests, at least in the middle latitudes of the United States, in the early part of the month of May. The structure is a work of some labour, formed of mud, and rendered stronger by an admixture of fine vegetable fibres. It is in the shape of an inverted cone, about six inches in diameter and five in depth, as measured on the outside; and the lip is generally enlarged in order to allow a resting place for the male when feeding the sitting female, or the two birds when feeding the young. There is no dome to the nest, and such an addition is not required, as it is made under cover; but the inside is carefully lined, first with fine dry grass, and then with soft and downy feathers. The eggs are usually four or five in number, white in the ground colour, and mottled over with small specks of reddish brown. They are, however, semi-transparent, which gives them altogether a slight reddish appearance. It is worthy of remark that in proportion as birds take greater care in providing soft and warm nests for their eggs, those eggs are always more delicate, finer in the shell, and approach more to transparency. Birds whose eggs have this character, are generally close sitters, they are almost all birds of firm plumage and rapid wing, and the greater number of them are migrant. The present species have generally two broods in the course of the season, and thus, while they remain in the United States, their life is a very busy one. There is also a sort of attempt on the part of the old birds to train the young ones to something like habits of independence, or of shifting for themselves in the world; for, before the young venture out of doors, they take a good deal of exercise in flying, along with the old ones, within side the barn or other shelter. Altogether this is perhaps the most interesting species of swallow which is met with on the American continent.

WHITE-BELLIED AMERICAN SWALLOW (*H. viridis*), has sometimes been confounded with the house martin of the eastern continent, but it is different in colour. The European martin is bluish black, and has the rump white and the legs covered with short feathers of a whitish colour. The American species is greenish on the upper part, has no white on the rump, and no feathers on the legs. It is a migrant, and arrives later in the United States than many of the others, and it resorts to the shrubby islands in the estuaries and rivers. The length of the bird is not quite six inches, and the extent of the wings is about twelve. The upper parts are light greenish blue with a rich gloss; the wings brownish black with slight reflections of green; the tail is much forked, the two exterior feathers being about a quarter of an inch longer than the middle ones. The under part is pure white; the close wings extend a quarter of an inch beyond the point of the tail; and the legs are short, strong, and naked of feathers, and of a purplish colour. The nest of this species has the principal part formed wholly of vegetable fibres, without any admixture of mud; but it is lined with a profusion of feathers, which are so disposed as to cover the eggs when the female quits them. These eggs are four or five in number, and of a white colour; and it is understood that the birds have generally two hatches in the course of the year. They are not exclusively insectivorous, but in the end of the season they resort to the swamps which are thickly covered with the candleberry myrtle, and feed upon the fruit of that plant,

becoming in high condition before they take their departure for the winter. When they resort to these places, they generally do it in dense crowds, so that though individually of small size, their accumulated numbers make them objects of some importance to the fowlers, who will sometimes kill from one hundred to two hundred at one shot.

There is a sand martin or bank swallow on the continent of North America; but as it does not appear to differ much from the European one, it does not require any detailed notice; but we may remark that it is singular that this species of swallow should be common to the two continents, when it does not appear that any of the rest are so. In south and central America, there are many species of swallows; but this article has already extended to so great a length, that we shall only mention one or two of the more remarkable. Before doing this, we may state that there is a very considerable difference between the migratory birds of our northern hemisphere and those of the southern one. This is what, from the physical circumstances of the two hemispheres, as well as from the lower latitude to which the land extends in the south, we might be prepared to expect. The openness of the southern ocean, which is never interrupted by ice at any of the three points of Van Diemen's Land, Southern Africa, and South America, admits of a complete circulation of the ocean waters, and of the atmosphere over them, by means of which the characters of the equatorial and polar parts of that hemisphere are kept within their own zones; and thus, though the southern hemisphere is, latitude for latitude, colder than the northern upon the whole, yet the seasonal differences for any one latitude are much smaller; and this circumstance necessarily occasions a corresponding difference in the movements of the seasonal birds. This is not the place for fully working out all the peculiarities of this difference; even though our limits permitted; but without taking this consideration along with us, we should be somewhat puzzled with the fact, that the southern swallows are comparatively resident, or at all events much more confined in their migrations than the northern ones.

THE WHITE-RUMPED SWALLOW OF PARAGUAY (*H. Leucorrhæ*) is rather a social species, and fond of coming near human habitations, and also of following travellers and their mules and horses in crossing the country. It is a resident species in the valley after which it is named, and also in other parts of South America. Its length is about five inches and a half; the upper part blue with reflections; the quills, coverts, and tail-feathers dull black; the rump, a streak over the eye, and all the under part white. This species builds indiscriminately in the thick heads of the palm tree and in holes of the ground, constructing its nest of vegetable fibres lined with hair and feathers. The entrance is in the side, and made so narrow that no animal larger than itself can enter, and so deep that neither the eggs nor the young can be got out without pulling the nest to pieces.

THE DOMESTIC SWALLOW OF PARAGUAY (*H. domestica*) approaches in its manners the swallows with which we are most familiar. It is blackish blue on the upper part, and velvet black on the cheeks, the quills, and coverts of the wing and tail-feathers. The sides of the head are brownish black, the front of the neck and flanks whitish, clouded with brown; the breast and belly white; the bill black; the feet violet

black in front, and reddish behind; and the tail very much forked. This species is very common in South America, resorting to cabins and country houses in thinly inhabited places, and to the churches and larger buildings in the towns. It constructs its nest externally of mud, but lines it with vegetable matter and feathers. The eggs are two or three in number. This swallow is more migrant than the one last mentioned, moving toward the equator during the southern winter, and northward during the summer. Such is a specimen of South American swallows.

HISPA (Linnæus). A genus of coleopterous insects belonging to the section *Tetramera*, and family *Cassididæ*, having the jaws short, with two or three smaller minal teeth. The antennæ are cylindrical, approximated at the base; and the thorax and elytra often clothed with acute spines. There is one reputed British species of small size (*H. atra*), but America is very rich in the individuals of this genus.

HISTERIDÆ (Leach). An extensive family of small coleopterous insects belonging to the section *Pentamera*, and subsection *Clavicornes*, of Latreille, distinguished by having the antennæ short, elbowed at the end of the first long joint, the four posterior legs inserted widely apart, the legs spinose and contractile. The club of the antennæ is nearly round, and then jointed, and the elytra are shorter than the abdomen, and rounded behind. The body is of a very hard consistence, and generally of a square form; the jaws are very strong and horny, and the palpi filiform. In several respects, as in the toothed legs and widely-inserted legs, these insects approach some of the lamellicorn beetles, but in their internal anatomy they seem more nearly allied to the *Silphæ*. The derivation of the name of this group has somewhat perplexed entomologists; they, however, appear to agree that it is derived from *Histrion*, a stage-player, although the cause of such derivation remains unknown. Herbet, indeed, supposes that the short square elytra, with red spots, in some of the species, might have suggested the name, in allusion to the dress of a buffoon. We, however, see a difficulty in the matter when we look to the natural history of the insect, which in England have thence obtained the name of mimic beetles, from the admirable facility with which they feign death when alarmed, by withdrawing their antennæ, and folding up their legs, so as to resemble a small black stone, or a seed; indeed, one of the species is hence called *Seminulum*. They feed upon bones, or other decaying animal matter, as well as upon dung and rotting vegetables. They creep but slowly. Their colours are shining black, or sometimes somewhat metallic.

This family corresponds with the Linnæan genus *Hister*, which, from its great extent, and the modifications of structure in different groups, has been divided into various genera by recent authors, amongst whom the memoirs of Dr. Leach, in the *Zoological Miscellany*, and of Dr. Erichson, in the *Jahrbücher*, are especially valuable. There are about fifty British species divided into the genera *Abræus*, *Orithophilus*, *Hister*, *Dendrophilus*, and *Platysoma*. The typical genus, *Hister*, has the body depressed, the four posterior tibiæ with a double series of spines, and the prosternum advanced beneath the mouth. The species are very numerous, and chiefly distinguished by the number of spines on the tibiæ, the striæ, and punctures upon the elytra and thorax. The type of the genus is the *H. unicolor* (Linnæus), a very abundant species,

of a black shining colour, varying from one-sixth to one-third of an inch in length,

HOG. See SUS.

HOG-NUT is the *Carya porcina* of Nuttall, a North-American tree allied to our walnut. The flowers are monœcious, and the caryas are placed in the natural order *Juglandææ*. They are commonly called hickory nuts, are less grateful than the walnut, but still wholesome and nutritious. The best are those of the *C. olivæformis* and *sulcata*, the kernels of both of which are excellent.

HOITZIA (Jussieu). A genus of handsome flowering plants from Mexico. They rank as greenhouse evergreen shrubs, and belong to *Polemoniaceæ*. Generic character: calyx five cleft, supported at the base by several serrated bractea; corolla, funnel-shaped, the limb divided into five lobes; stamens protruding; capsule three-celled, three-valved, and many-seeded. These plants thrive in a mixture of sandy loam and moor-earth, and are propagated by cuttings.

HOLLY is the *Ilex aquifolium* of Linnæus, a well known evergreen shrub, a native of Britain. The common holly, or holme, or hulver of which we have many varieties, is the only British species of *Ilex*. Here it seldom exceeds the size of a bush, though in some places, both in France and England, they grow forty or fifty feet high. Its prickly leaves fits it well for hedges, and when Dutch gardening prevailed here gardens were portioned out by well-clipped holly hedges. The celebrated Evelyn had one at Says'court, four hundred feet long, nine feet high, and five feet broad, which he had planted at the suggestion of Peter the Great, who resided at his house when he worked in the dockyards at Deptford. And in his "Sylva," he asks with rapture, "Is there under heaven a more glorious and refreshing object of the kind than such an impregnable hedge, glittering with its armed and varnished leaves, the taller standards at orderly distances, blushing with their natural coral." The finest holly hedges in Britain, or perhaps in Europe, are at Tynningham, these at of the earl of Hadington, in East Lothian. The holly is a slow growing tree, and the timber is among the hardest of the white woods. It is much used by turners, and especially in the manufacture of Tunbridge ware. The liber abounds with a tenacious liquid, which, when separated by bruising and maceration, is known as bird-lime.

HOLLYHOCK is the *Althæa rosea* of Cavanille, a native of China, and one of the principal ornaments of our gardens. The hollyhock is a biennial, and therefore, to keep up a stock, seed must be sown every spring, usually in a hotbed, and there nursed till the plants are large enough to be put out in the open borders. They are usually planted in shrubberies.

HOLMSKIOLDIA (Retzius). A genus of two beautiful plants, one an evergreen shrub from Peru, and the other a climber from India. They belong to the natural order *Verbenaceæ*. Generic character: calyx large, spreading, coloured, faintly five toothed; corolla tubular, limb divided into two short lips, the upper one two-lobed, the lower one three-lobed, side lobes short, middle one oblong, entire and deflexed; stamens protruding, bearing oval anthers; style filiform; stigma unequally double; berry four-lobed, clubbed, one-celled and many-seeded. This genus was called *Hastigia* by Smith, and *Platunium* by Jussieu. They grow in any light rich soil, and are propagated by cuttings.

HOMALINEÆ. A small natural order, containing four genera, namely *Homalium*, *Blackwellia*, *Astranthus*, and *Aristotelia*. These are tropical shrubs or small trees, with simple, entire, alternate, impunctate leaves, and free deciduous stipules. The inflorescence is spicate, racemose, or paniculate; the pedicels without bractea, and the flowers regular and united. Little is known of the general properties of the Homalineæ. *Aristotelia maqui* is the maqui of Chili, the berries of which are eatable; they are about the size of peas, of a very dark purple colour, becoming ultimately black, and of an agreeable acid flavour. The native Chilians make a wine of their juice, and in a fresh state they are esteemed as a febrifuge, and reputed to be serviceable in malignant fevers. The bark is astringent, and contains so much gallic acid, that it blackens rapidly the instruments with which it is cut. This is the plant which Dombey used with such remarkable success in Chili, in the year 1782.

HOMERIA (Ventenat). A genus of bulbous stemmed herbs, natives of the Cape of Good Hope. *Monadelphica Triandria*, and natural order *Irideæ*. Like all the rest of the order the flowers are conspicuously beautiful, and are cultivated like other Cape bulbs, in a mixture of sandy loam and moor-earth; kept quite dry when dormant, but watered freely when growing. This genus was formerly called *Moræa*, by Jacquin and other botanists.

HOMOPTERA (Latreille). A sub-order, according to Latreille and Kirby (or a distinct order, according to Leach, MacLeay, &c.), of insects separated from the Linnæan order *Hemiptera*, having the wing-covers generally deflexed, of the same consistence throughout, the antennæ mostly short, and terminated by a bristle, and the body convex and thick, with the thoracic segments united into a mass, the first very generally shorter than the second; the proboscis also arises nearer to the posterior part of the head, sometimes even appearing pectoral. All the insects of this group subsist upon the juices of vegetables, which they obtain by the assistance of their articulated proboscis, and sometimes, as in the case of the aphides and sugar-cane fly (*Delphax sacharivora*), the mischief which they occasion is very extensive. The females are furnished with a scaly ovipositor, composed of three toothed saws, lodged, when at rest, in a bivalve sheath at the tip of the under side of the abdomen. With this apparatus they are enabled to make an incision in the leaves or stems of plants, into which they afterwards introduce their eggs.

Latreille divides this sub-order into the three following divisions:—

1. The *Cicadariæ*, having the tarsi three-jointed, and the antennæ very short, terminated by a fine bristle, comprising the families *Cicadidæ*, *Fulgoridæ*, and *Cercopidæ*.
2. The *Aphidiens*, having the tarsi two-jointed, and the antennæ longer, without a terminal bristle, containing the families *Aphidæ* and *Psyllidæ*. Latreille also here places the *Thripsidæ*, but its organisation renders this location doubtful.
3. The *Gallinsecta*, having the tarsi one-jointed, terminated by a single claw. The males have two wings, and are destitute of a mouth. The female is wingless, and furnished with a sucker. Comprising the single family *Coccidæ*.

For an account of these families, &c., see the several articles thereon.

HONEYSUCKLE. This beautiful genus of flowering shrubs occupies a very prominent situation in the shrubbery and flower garden. It belongs to the class and order *Pentandria Monogynia*, and is better known in the language of poetry as the *woodbine*. It was common in the flower gardens of the ancient Greeks, and we find it a never failing theme with our earliest poets when they wished to furnish a striking emblem of devoted attachment. Thus Chaucer, the father of English poetry, says,

“ And tho that were chapelets on her hede,
Of fresh wodebind, be such as never were
To love untrue, in word, in thought, ne dede;
But ay stedfast; ne for plesance ne fere,
Tho that they shulde hir hertes all to tere,
Woud never flit, but ever were stedfast.”

It is probable that the common English name of honeysuckle is derived from the facility with which children draw forth its trumpet-shaped corolla from the calyx, and thus suck the honeyed sweets with which it abounds from the nectary. This part of the plant is so formed as in a great measure to bid defiance to the industrious bee; but the hawkmoth readily extracts the honey from the very bottom of the flower; and as much would still be left to waste in the plant, there are many insects which, by a beautiful natural instinct, perforate the tubes at their base, and thus draw forth the honey in a stream.

The woodbine has a light and elegant air, better calculated to ornament rural groves than the more elaborately finished garden; and a much more suitable climber for the rustic porch than the stately portico. The common honeysuckle will, however, grow in almost any situation. This plant is usually propagated either by layers or cuttings, and September is the best month for planting them.

When we look at the little attention this beautiful climber requires at the hand of man, it must be a great source of regret that it is not planted in greater quantities in the parks and public gardens near the metropolis. We have not even seen it in the Regent's Park, and yet the delightful aroma of its flowers, and the pleasing tints they exhibit, would form a most interesting feature in the shrubberies, as even the bare trunk of a lightning-scathed tree would serve as a support for its pendulous wreaths.

HONEYWORT is the *Cerinth major* of Linnæus. They are European annuals and biennials belonging to *Boraginæ*.

HOOKERIA (Smith) is one of our British mosses, so called in honour of Dr. Hooker of Glasgow. A bulbous-stemmed plant was also called *Hookeria* by Salisbury, but is now changed to *Brodiaea grandiflora*.

HOPOE (*Upupa*). A genus of birds, ranged by Cuvier in the tenuirostral family of *Passerinæ*, and by him restricted to two species, both of them natives of the eastern continent. When the characters of their feet are taken into the account, these birds rank with the anisodactyli, that is, with those that have the toes of unequal length, the middle and exterior ones united at their bases, and the hind one considerably produced. No general conclusion can, however, be drawn from the possession of this species of foot, for, though it may always be regarded as an active and efficient one, it is modified so as to suit many kinds of surfaces. The structure of the feet of these birds is, therefore, now very generally omitted in the descriptions of them, or treated as only a very subordinate matter. The generic characters are: the bill very

long and slender, triangular in the section, compressed, slightly arched; the upper mandible longer than the under; the nostrils oval, basal and lateral, open, and protected by feathers; there are three toes to the front, the middle and outer one united as far as the first joint, and the hind one is rather long, and has the claw quite straight, or nearly so; the wings are of mean length, and rounded, the first quill being shorter than the second and third, and the fifth and sixth the longest in the wing; the tail is composed of ten feathers, all of equal length.

These characters of the bill, the feet, and the organs of flight, are all well made out, and harmonise so much with each other, that they form a ready and perfect key to the haunts, action, and manner of feeding of the birds. The bill is properly an insectivorous bill, intermediate in its form between the bills of the humming-birds and those of the bee-eaters; but the form of the wings, which fits them more for ascent and descent than for turning rapidly so as to catch prey on the wing, confines the birds to a different mode of finding their food. The feet combine the properties of perching and those of walking feet; and, while the union of the two outer toes afford a purchase for walking on soft earth, the production and strength of the hind toe, and the shape of its claw, adapt the bird especially for grassy surfaces. On the ground the hoopoes march with a sort of strut, bearing some resemblance to that of the gallinidæ; and yet they not only perch with great firmness upon low bushes and stumps by the margins of the waters, which form their usual roosting-places when watching for their prey, but they can, upon occasion, cling to perpendicular surfaces, though they have not so much command of themselves there as the creepers. It is worthy of remark, that there is a considerable difference in the kind of action of this foot and the zygodactylic foot, which shows how beautifully each of them is fitted for its particular purpose. The zygodactylic foot, from the complete reversal of the outer toe, which is free to its articulation, in order that it may have this position, is a foot for rest upon vertical surfaces; and therefore, though the motions of these birds on such surfaces are sure, they are very slow. Such a foot as that of the hoopoe is, on the other hand, a rapid foot, but not adapted for adhering to the same part of a vertical surface for any length of time; and hence birds which have it are active in their motions, and do not dig insects or larvæ out of chinks of trees or other hiding-places, but capture them in the free air, though such long and slender billed ones as the hoopoe can reach that upon which they feed either in thick herbage or at some depth under water.

The hoopoes are also birds of very powerful wing, though their momentary flight is not so rapid, or their power of turning in the air so great, as that of birds which have the wings larger and more narrow and pointed. We must not in all cases estimate the absolute power of a wing by the length and pointedness only; for those circumstances are adaptations to a particular style of flight, and not to flying generally considered; for this last purpose, and when the flight is mere transfer from place to place, rather than beating about in the air for food, the broad wing possesses some advantages over the long and narrow one. There is no doubt a limit to this; but there is also a proportion between the length and breadth, which gives the maximum of power in a carrying wing;

and we find in the hoopoe very nearly the greatest advantage of this proportion. And when we advert to the habits of the bird, we cannot fail in being struck with the beauty of this adaptation. It is only for transport from place to place that the hoopoes use their wings; for they feed standing or perching. In transporting themselves, they have two species of flight: the one consisting of short journeys over their feeding grounds, when the character of the season induces them to be resident there; and the other, migration flight, in the course of which they are discursive, and often pass over long distances. The wings are equally adapted for both styles. Their breadth, their roundness, and the co-operation of the powerful fan-shaped tail enable the birds to get up and down with the greatest ease upon their short excursions; while the general power of the wings is equally serviceable on those longer flights which the variation of the seasons render necessary.

The hoopoes are inhabitants of the banks of rivers, chiefly of those rivers which are alternately flooded and low, from the alternation of rain and drought. There they feed upon beetles, and other ground insects, and on the spawn of fishes and reptiles. The number of insects which they capture is very great; so that they render no unimportant services to those countries which they frequent, from their activity; they are necessarily voracious feeders, and their nests are somewhat rank with the remains of their abundant food, as is the case with the bee-eaters, the kingfishers, and most of those birds of powerful wing and frequent flight which haunt the margins of the rivers. As is the case with most, if not all of the section, the hoopoes are very handsome birds, fine in their forms and graceful in their motions. There are only two species of them, one of which ranges for a considerable extent over the tropical and northern parts of the eastern hemisphere, over the southern parts of the same, we believe principally confined to Africa, though it also occurs in the south of Asia.

COMMON HOPOE (*U. epops*) is a very beautiful bird, measuring about a foot in length, and a foot and a half in the stretch of the wings, and weighing about three ounces. On the upper part it is of a rust colour, or rather of a vinous red, with the wings and tail black, crossed with two white bands on the wing-coverts, and four on the quills; the tail is crossed by a crescent-shaped bar of white; and the crest-feathers, which are orange, tipped with black, formed of two rows, and capable of being erected at the pleasure of the bird, give the bird a handsome appearance; the head, neck, and breast, are brownish red, and the rest of the under parts are whitish, streaked with brown. These birds are very discursive with the seasons; they chiefly winter in Africa, at least in the European longitudes, while in the eastern part they find their way southward to India. In the south of Europe they appear in considerable numbers, generally in small flocks, which arrive in the extreme south about the month of March; but they do not make their way to the middle latitudes until the end of the spring, and they retire again at the close of summer. In Britain they appear only as occasional stragglers, and, from the season at which some of them have been obtained, one would be led to suppose that they are strays, who have lost the proper line of migration, and so cannot find their way back again to the south. Within these few years one was shot in Cornwall in the month of December, which

is more than three months later than the time when the regular migrants depart from central Europe. Their straggling into this country bears some resemblance to that of the bee-eaters, pratincoles, and other birds which belong to the central valley of the eastern continent, much more than to the countries on the shores of the Western Sea. We look for our regular migrant birds in the warmth of summer only; or chiefly, in the southern parts of the country; but such a bird as the hoopoe is just as likely to occur in Caithness as in Cornwall, and in the Orkneys or the Hebrides, as in the isles of the Channel. In the eastern parts of the continent they range much farther to the north on their summer excursions, and are not uncommon in Russia, or even in Siberia. This might, however, be expected; for, though the winters there are exceedingly cold, and the summers of short duration, those short summers are very warm, and the country is thronged with such animals as those upon which the hoopoes feed.

Hoopoes, and also some of the other birds which most resemble them in haunts, habits, and character, are understood to make a sort of perpetual summer of it, unless in the case of such strays as happen to fall upon our winter, by missing the line and time of their migration. In consequence of this, the birds are understood to breed two or three times, or even more frequently, according to circumstances, in the course of the year. The nest is described as being rather miscellaneous in its position, but, true to those migrant birds of the banks of rivers, always in some sort of concealment. It may be in a hollow tree, among the tangled roots near the ground, in a hole of a wall, or a crevice of the rock; and though the female does adapt her labour in building so as slightly to improve the less commodious places, yet she is no very skilful nest-builder; and the extent of her labour usually goes no farther than collecting, first, a few withered leaves, and then a few feathers. The hatch varies much in number, being as many as seven when the situation and season are peculiarly favourable, and not more than two when circumstances are the reverse.

In Egypt and several other parts of Africa the birds frequent the meadows in the close vicinity of human dwellings; but on their northern excursions, they are rather fond of solitary places. In Egypt indeed they are greatly encouraged, from their labours in destroying the insects with which the humid banks of the Nile are infested, and accordingly they are as familiar and have their nests as much intermixed with the dwellings of the people as the common house swallows have with us. The eggs are oblong, of a bluish white colour, and marked with small spots of pale brown. The young have to be fed for a considerable time in the nest, and the feeding of them is rather a laborious occupation for their parents. As is the case with all birds of similar habits, the hoopoes have no song, but they have a sort of three calls; one a hollow booming note thrice repeated without modulation; another a little more musical, but still not modulated, which is the love-song; and a sharp hissing note, which is the sound of alarm. In their low flight they jerk on the wing, flirting the tail at the same time; and when alarmed they erect the crest and spread the tail fanwise. They are very easily tamed, and can be made to remain without confinement if they are properly fed. Their flesh is eaten in the south of Europe, but is not understood to be of much value.

The species of Southern Africa is smaller than that now mentioned, its body is nearly black all over, and its length is only nineteen inches. It occurs in India



Hoopoe.

as well as in Africa; and there are some birds there which seem to connect the hoopoes with the bee-eaters, but their manners are little known.

HOP is the *Humulus lupulus* of Linnæus, a useful and well known British agricultural plant. See HUMULUS.

HORDEUM (Linnæus). *H. vulgare* is the well known barley, one of the most useful of the cereals. The cultivation of barley is one of the principal objects of British agriculture, and is of vast importance to the state as well as to the community at large. A large revenue is derived from the manufacture of the grain into malt, whence is drawn the favourite beverage as well as the destructive spirituous liquors of the people. A fourth or a fifth of every well managed farm of light land is annually sown with this grain, as the straw is an excellent winter fodder for cattle. Heavy clayey soils are not suited to barley, as it can with difficulty be got fine enough for the reception of the seed. March and April are the months for sowing; and when laid in in a proper manner, that is in soil perfectly pulverised, dry, and warm, the crop is ripe in nine or ten weeks. There are several varieties of barley in cultivation; but the flat-eared sort (that is when two opposite ranks of the spike are abortive) is the most esteemed. An average crop is from three to four quarters, or about thirty bushels per acre.

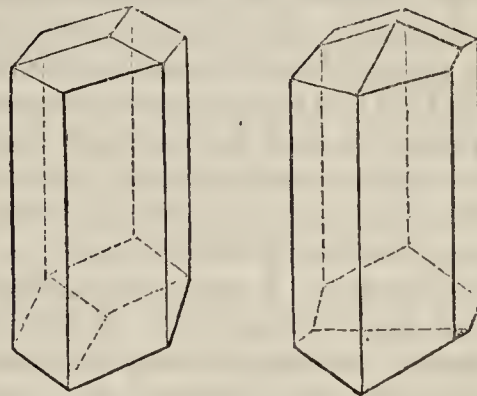
HOREHOUND is the *Marrubium alyssum* of Linnæus. A well known medicinal herb belonging to *Labiata*. An infusion of the leaves has been found serviceable in chronic catarrh, and humeral asthma, and made into a syrup or confection, or candied with sugar. they form a popular remedy for slight coughs; and though not used much professionally, they appear to deserve more attention than they now receive.

HORIA (Fabricius). A genus of exotic coleopterous insects, belonging to the section *Heteromera*, and subsection *Trachelides*, having the jaws pointed at the tip, the claws denticulated, with a long bristle attached beneath each; the antennæ filiform, and the hind legs often very thick. This genus is the type of one of the families into which the *Trachelides* is divided by Latreille. The species are of moderate size: the larvæ, according to a Memoir by Mr. Guilding, in the Linnæan Transactions, destroy those of a large species of carpenter-bee (*Xylocopa*), the female of which

pierces the trunks of dry dead trees, and then makes her cells. The larvæ of the beetle is also found in the same situations, where it devours the food prepared for the bee-grub, and thus causes the latter to perish.

HORNBEAM is the *Carpinus betulus* of Linnæus, the common hornbeam of British woods, belonging to the natural order *Amentaceæ*. The tree is raised from seed, and is a very striking plant in forest scenery. The timber is much used in the construction of rustic implements of husbandry, especially yokes for cattle, whence its name; its catkins are said to be sometimes fraudulently mixed with hops.

HORNBLENDE. This mineral forms a very important constituent in the granitic masses which appear to form the giant ribs of our globe. It is of a greenish black colour, and consists of silica and alumina with magnesia. Its peculiar tint is principally derived from oxide of iron, of which it contains from twenty to thirty per cent. Hornblende sometimes passes into *mica*; and if the component parts of the two bodies be compared by chemical analysis, the principal difference will generally be found to consist in the hornblende containing the largest proportion of iron. Those granitic chains which contain the largest quantities of hornblende, usually split into immense blocks, separated from each other by natural seams, and appearing like the ruins of edifices con-



Hornblende.

structed by a race of Titans. The crystalline character of this mineral is delineated in the above diagrams.

HORNET. The largest Hymenopterous insect found in England, belonging to the section *Aculeata*, sub-section *Diploptera*, of Latreille, and family of the wasps, *Vespidæ*, being systematically known by the name of *Vespa crabro*. This insect, of which the females are fourteen lines long and the males and workers eleven, is of a rich red-brown colour, with darker markings upon the thorax; the head and abdomen buff coloured; the basal segment (except the posterior margin), half of the second segment, and a triple series of spots on the following segments, brown. The nest of this insect is in its general construction similar to that of the wasp, although of coarser materials, and the columns supporting the layers of cells much stronger. It is constructed either in the hollows of rotten trees, such as willows, poplars, or old oaks, or in the thatch, or under the eaves of barns, and not unfrequently in timber-yards and other similar situations. It is difficult to obtain a sight of their proceedings whilst building; for if the aperture by which they approach to it be too large, they lessen it with a wall of the same material as their cells are composed of, and which, according to Kirby and Spence, consists of decayed wood, but, according to

Reaumur, of the bark of the ash-tree gnawed to pieces. With this material, moistened by a viscons fluid which they emit, they construct a kind of fragile pasteboard thicker than that made by the wasp, but at the same time not near so pliant, easily breaking between the fingers, of a buff colour, and not at all shining. If the nest of the hornet should not fill the cavity in which it is commenced, they protect it by a common covering of a single piece, not being composed of a series of distinct layers placed one above another. To compensate, however, for this, the covering is of a much stronger consistence, being about four times as thick as the layer of the wasp nest. Reaumur has figured a nest thus protected, which he found in a cavity in a wall, and which, as well as one described by St. Fargeau, in his work just published upon the Hymenoptera (Suites à Buffon, liv. 14), was attached by a footstalk, and defended at its base by one of these coverings, which considerably resembles in form the paper cone in which grocers lap their moist sugar. Beneath this covering the footstalk is dilated and supports the first layer of cells. The subsequent layers are affixed by means of upright pillars, of which the central one is the strongest. The nest is of a somewhat globular form, and the cells are much fewer in number than in the wasp's nest. This insect devours other flies, especially bees, the honey of which it also steals; it also devours almost any other kind of fresh animal substances which it can obtain, ripe fruit, &c. From the size of the insect its sting is very powerful, and is much to be dreaded.

HORN POPPY is the *Glaucium flavum* of Decandolle. A European herb belonging to *Papaveraceæ*. Some of the species are annuals, others biennial; and are occasionally seen in flower-gardens on account of the curious structure of their flowers.

HORSE (*Equus*). A genus of pachydermatous mammalia, but distinguished from all the rest of the order by having only one toe on the foot fully developed, enlarged, and enclosed in a solid hoof. Hence several naturalists have made a separate order of the horse, under the name of *Solipedes*, or entire footed; under which name the genus is made a separate section by Cuvier in his "Animal Kingdom." Though there is only one toe fully developed in the horse, there are rudiments of two others under the skin, but they make no appearance externally.

The general characters are: six incisive teeth in each jaw, which when the animal is young have their crowns marked with a single furrow of considerable depth. There are six grinders on each side of both jaws, which have their crowns square, and crossed with laminæ of enamel. In the upper teeth there is a small disc of enamel on the inner edge. The males have one small canine tooth, and sometimes two, on each side of the upper jaw, but none in the under; and these canines are always wanting in the females. Between the canines and the first grinder there is a large open space. The jaws have much less of a grinding motion than those of oxen and other ruminant animals. The stomach is single, and the intestines very long, and furnished with a cæcum of vast size. The feeding apparatus of these animals is but ill adapted for dividing their food, it is carried into the stomach with comparatively little preparation; and the alimentary apparatus resembles a distilling one more than any thing else, the nutriment of the animal being in many instances only a tincture drawn

from the food, which passes through, in many instances, without much apparent change; and the droppings of horses are not so offensive to the smell as those of any other animal. There is another circumstance which shows the imperfect action of the stomachs of these animals upon their food; and that is the great heat which can be produced by the fermentation which the dung of horses undergoes when it is collected in heaps. This renders it a very important article in the cultivation of many plants which require greater heat than that of the season to force them into growth; and by means of this substance, the people of England and similar countries are enabled to rear melons, and other rich fruits of the sunny lands, in as great perfection as they are raised in their native countries. Nor is the advantage derived from manure furnished by horses confined to the forcing of those exotic plants which minister to luxury; for in every country in which horses are abundant, it tells equally upon all cultivated fields; and while the horse is the grand power employed in agriculture, it also furnishes the grand stimulant to every thing that the field produces. There is no country where horses are so numerous, in proportion to the breadth of the land, as they are in England; and owing to this very circumstance, there is no country where various soils yield so abundant a crop of the food of man, or of that of domestic animals. As an instance of this, we may mention the comparatively small breadth of land which suffices to supply the City of London, and its attached boroughs and surrounding villages, with culinary vegetables. As the thing is actually done, and done in so quiet and systematic a manner as that nobody thinks any thing about it, we are apt to pass the matter unheeded; but if the problem were put in a country where there was no such place as London, "to find green vegetables for a million and a quarter of human beings, (something like the inhabitants of the half of Scotland), concentrated within a circle of five miles radius," the problem would be reckoned absolutely impossible; for even those parts of the country which are most thinly populated, and where, consequently, each individual enjoys the produce of the greatest breadth of land, the people are no where better served with vegetables than they are in this same London; if, indeed, they are served as well. This does not apply to the quantity only, for it is equally true of the quality and of the freshness; while the inhabitants are exempted from all trouble in the growing of these things. Now, it is in a great measure owing to the vast number of horses which are employed in the metropolis that this abundant and excellent supply is obtained; because the quantity of horse-manure, incorporated with the soil of the market gardens, keeps it in a continual state of excitement, and produces all the year round, and more especially in the winter season, a much higher temperature than the earth would naturally have in our climate; so that, with a few simple contrivances of art, vegetation is kept up during the winter; and by a skilful adaptation of plants to seasons, the market gardens are kept in continual crop. Now without dressings, of not only a rich, but of a warm and stimulating nature, it would be quite impossible to do this; and thus, were it not for the horses, the art of those cultivators would be, in a great measure, exerted in vain. Nor is it in the metropolis alone, that this advantage is felt, for it applies to every district of the country;

and, whether they are applied to the purposes of agriculture or not, it may be said that the profitable culture of the ground depends in a great measure upon the abundance of horses; and no inconsiderable portion of the superior fertility and consequent value of the lands, immediately abutting on the principal lines of road, is owing to the number of horses which are necessarily kept for the purposes of travelling along those lines. It becomes, therefore, a question of some importance whether, if rail-roads and steam-carriages should ever be introduced as the principal channels and powers of land-carriage, the country might not thereby sustain a loss in the deterioration of its soil, and the consequent diminution of its agricultural produce, for which no rapidity of communication would compensate; for we need not say, that rapid carriage would be of little avail if there were nothing to carry.

It is indeed a truth at once demonstrative to the eyes of every one who chooses to look fairly at it, that the great triumph which British agriculture has gained over the stubborn opposition of inferior soil and wayward climate, is owing more to the vast multitude of horses in the country, than to almost any other cause. At all events, the co-operating circumstances, such as improved implements and modes of culture, and a better understanding of the nature and character of the seasons, would have been unavailing without this one. Nor are the evidences of the truth of this few or difficult to be obtained. Any one who is old enough to remember when, in the poorer districts of the country (and it makes for the argument that they lingered the longest there), oxen or steers were employed to drag along the clumsy and crawling plough, or the lumbering wain, must also have observed with what strides fertility and improvement of every kind came onward with the introduction of the horse. So marked, indeed, has this been in some districts, that it would almost tempt one to believe that the tread of the solid hoof had something of the fancied power of a magic wand about it; and, that the moment that it comes in sufficient number and repetition, the golden harvest waves richly in the autumnal wind, over slopes which were erewhile clad with nothing but brown heather. In most parts of England, the agriculture is owing chiefly to matters of human arrangement, with which we have, in the mean time, no concern, inferior, in proportion to the natural advantages of the climate, to that of many districts in the northern part of the island; yet the horse was introduced at so early a period that there are scarcely any who remember the state of things under ox cultivation, so as even to be able to contrast it fairly with horse cultivation. But the writer of this article remembers well a pretty extensive district of North Britain, when it was in a great degree, at least, cultivated by oxen. At that time wheat was unknown; and even barley was grown in small quantities, and of the light upland kind, called *bigg* or *bere*, which was feeble in the straw and poor in the ear, and very generally so late in ripening that it was caught standing by the heavy autumnal rains, and sprouted, so that each ear looked like a tuft of grass on the top of the stalk. The only other crop, with the exception perhaps of a little patch of grey field peas, consisted of oats, not unfrequently of the black or bearded kind, in which the quantity of farina is small and dark coloured; the crops of these were often so stunted that when full grown, they did

not cover the clods; and it was not rare to find the little *shocks*, which, though consisting of twelve sheaves, were not bigger than hill sheep, standing bleaching in the fields till Christmas.

Some two dozen or two score years rolled on, bearing the spring-tide of improvement upon their wings; and in process of time the ox disappeared from the plough and the wain, and was served up at the table, while the horse put his gallant shoulder to the labour of the wheel. The consequence is, that at the present time, the farmers of that very district depend mainly on the wheat crops for the payment of their rents, or, in supplement to that, to their barley crops; and the greater part of the oats which they grow is used for the feed of those noble animals which have, in truth, been the main-spring of the whole improvement.

Nor must it be supposed, that the introduction of the horse as a labourer was the means of banishing the ox; for on the other hand, the breed of the cattle has been greatly improved, and their numbers very much multiplied; so that we may say the horse has, to a great extent, been the benefactor of the ox, as well as of the owner of both. And it is easy to see the reason: with ox culture, the quantity of manure for the arable land is comparatively small; and as from the rumination and more complete digestion of the ox, the manure is in a more exhausted state, and does not ferment, give out heat, and act as a stimulant like that of the horse. Horses, in order to work properly, cannot be fed wholly on pastures; and upon a pasture which will support and even fatten cattle, horses would be starved. Besides, unmixed grain and succulent food disorder the bowels of horses, and render them unfit for working. Owing to these circumstances, the horse must be, in great part at least, fed in the stable; and consequently, a great deal of nourishment for the land is accumulated. Not only this, but the use of horses in agriculture renders it necessary to cultivate grasses for animal food, as well as the cereal grasses for the food of man, and the more substantial dry-feed of the horse. Also, the introduction of beans, which, though profitable only in strong land, do not exhaust the strength of that land nearly so much as wheat crops do, follow as part of the system of cultivating the land by means of horses. In short, the great quantity of manure, which, up to a certain point at least, increases the value of the land in a route of geometrical progression, lays the foundation of a vast deal of vegetable cultivation and of animal food. We owe to it not a little of the successful culture of that prince of roots, the potato; and we may be said to owe wholly to it the culture of the turnip, the carrot, and mangel wurzel, which, in proportion to the breadth of land which they occupy, yield a greater quantity, and we may add a better quality of food for animals than any other known plants.

With these, and the cultivated grasses and trefoils, and the amelioration of the land by means of tares and other plants, which may be cut down for green-feed in the summer season, the horse has really brought a mine of wealth about the farm; and he may be said to be a most efficient agent in feeding even the pigs and the poultry.

It is unquestionable that the introduction of animal food for general consumption, and of wheaten-bread in the poorer districts, have followed in the proportion of, and therefore have been produced by the introduction of the horse as the principal labourer; and,

were it consistent with the plan of this work to go fully into the question, we feel convinced that we could prove, in the clearest manner, that the superior conquest of soil and climate which England enjoys above all countries in the world, is owing to the greater number of horses, which find so much food for themselves, as well as for all the other domestic animals, and for man.

The proof of this is not confined to the progressive history of our own country, for we have a sort of inverse proof in the case of some other countries, as, for instance, in that of Poland. There was a time when Poland was the granary of Europe, and at that time Polish horses were celebrated; but, in the many vicissitudes which that unfortunate country has undergone in the close of the last century and the elapsed part of the present one, the circumstances of it have been completely changed. One foe or one friend, or friend and foe both, acting a part equally unfriendly, first drained Poland of its horses, for the supply of those armies to which its hapless fields served as a thoroughfare; and no sooner had this cruel exhaustion taken place, than its agricultural produce became diminished in quantity and altered in kind. Up to that period a very great breadth of Polish land, even under one of the most execrable fiscal systems that ever cursed a section of the human race, was employed in the growth of wheat; and though the produce, acre for acre, was perhaps never anything like what it is in the very best parts of this country, yet it was, upon the whole, abundant, so as to enable a large quantity to be exported. Now, however, the case of Poland is sadly altered. There are no doubt some limited districts in which wheat can still be grown to advantage, but these are the districts which are annually made fat by the impoverishment of the rest of the land, through the agency of the heavy falls of rain, and the flooding of the streams and rivers. But the great breadth of the country is absolutely unfit for wheat, not well adapted for oats, and affords but scanty crops even of rye. In consequence of this, a great portion of the breadth of land has been thrown into sheep pasturage, and considerable amelioration has taken place wherever this has been introduced. This depasturing with sheep will in time bring a healthy sward upon the surface, which will retain the rich portion which the winds and rains sweep and wash away when the surface is naked; and thus the land may, by careful management, be renovated in the course of time. It will take a considerable time, however, before Poland shall again be what it once was. The circumstances of Poland are no doubt peculiar in so far. It is, generally speaking, a light sandy or gravelly soil, chiefly the former; and, although this is the foundation of fertility where the land can be "kept in good heart," yet such a soil is always hungry, and hungry in consequence of that activity which renders it fertile under proper management; so that it will not be till the number of domestic animals, and especially horses, shall be greatly increased, that Poland will again become a rich corn country.

We have taken this view of the utility of the horse in preference to any direct allusion to the use of the animal on the farm, the road, the race-course, or the battle-field, because the use of the horse in all these respects is palpable to every one's observation; and therefore, if we were to enlarge upon any of them, we should be merely stating that which almost every

reader has daily opportunities of observing for himself. We have done it, too, because, at this moment, the question is one of serious interest to all who wish to promote the agriculture of the country. The projects which are before parliament, or in preparation, for establishing railway communications upon all the great thoroughfares, which shall render the use of horses for the carriage of goods and passengers quite unnecessary, are no doubt as legitimate as any other kind of speculations; and though it is probable that the greater number of them will totally consume the funds expended on their construction, without any corresponding advantage to the public, yet it is doubtful whether that ought to be made illegitimate ground of objection to them; for, from the periodical exposure of bubbles of one kind or other which takes place in this country, and after which business becomes generally so much more wholesome than it was before, it really appears that there is in this country a power of producing wealth beyond the wholesome necessity for it, just as there is in some constitutions a disposition and over-production of blood, and that a sort of leechcraft and phlebotomy, by means of which the surplus runs to waste, is as necessary in the one case as in the other. The professional difference of the two cases is, that lawyers, projectors, engineers, persons cunning in making great holes in the earth, and multiplying brickbats without number, are the pecuniary leeches, and fatten on the blood of those whom they "ease," which is not the case with their brethren of the lancet.

Nor need we offer any apology, even to the most fastidious reader, for introducing this subject in our notice of the horse; for, as the horse is far more of a domestic than a wild animal, the most important part of his history is its bearing on the general welfare of society.

The chief objection to the origin of those projects is the incapacity of the parties with whom they originate for judging of the bearing of the project upon the interests of society. We say it with great deference, but it is nevertheless true, that, beyond statute, custom, and authority, lawyers are an exceedingly ignorant class of men, and that they should be so may be said to be a matter of necessity, that is, a necessary result of their education and habits. Their official perfection consists in taking the most narrow and partial view of a case, and concealing all the rest as much as possible; and because of this a good lawyer, that is, one profoundly versed in the small subterfuges of law, always makes a very partial and dangerous legislator. It is doubtful whether the matter is improved by the other parties who combine with lawyers in the concocting of such projects, because they belong to a class very properly called schemers, very many of whose members and whose plans are visionary. It should seem, therefore, that it would have been desirable to institute somewhere an inquiry into the effect which the general introduction of railways on the great lines of communication is likely to have upon the number of horses; and, again, what effect this is likely to have upon the agriculture of the country. It is quite clear that no description of railroads can be carried into the details of the localities, and that they cannot be profitably used except on the thoroughfares of great traffic, if indeed they can be so there. Therefore, there must still be cartage and carriage-driving on the byways and country roads, and across the farms; and to all such carriages as are

adapted for any of these a railway must be an effective cutting off of the country from the towns, and of the towns from each other. This is, no doubt, in a great measure an imaginary evil, because it is one which the country will not permit, inasmuch as folks will continue to ride horses and drive carriages from one end of the country to another, despite of all the railroads that can be constructed. It is proper, however, that people generally should have a right understanding of the value of the horse, not merely as a working animal, but in the effect which it has upon the general productiveness and general value of the country; and it would be just as well if, when such a project as a railroad is under consideration by the legislature, some of those who profess so warm a zeal for the interests of agriculture would broach this subject, were it only for the purpose of making it better understood.

Of the genus *Equus* there are not many species—probably not more than four; the horse, properly so called, the ass, the zebra, and the quagga—though there appears to be some varieties of the last. They all resemble each other in the structure of their skeletons and the number and form of their teeth, as well as in their digestive organs, much more than almost any other genus of animals. The chief differences, indeed, upon which the distinctions are founded are external, consisting in the different lengths of the ears, the different character of the hair, more especially that in the mane and tail, the different markings, and the general air and expression. So far as is known, all the species are capable of intermixing so as to produce mules; and those mules are perfect animals, capable of breeding back to the pure blood, though two which are equally distant from the purer blood will not breed with each other. Some remarks on this subject will be found in the article Ass; and as we have, in that article, treated as fully of that species as is consistent with our limits, we shall confine the remainder of this article to a brief notice of the remaining species and their leading varieties.

We may, however, observe of the whole genus, that they appear to belong, as natives, to a different state of the earth than that which its present surface now presents. The wild ass, the zebra, the quagga, and also the wild horse of Central Asia, are all found on the margins of the great sandy deserts, or at least in those regions where there is a great breadth of country, which is alternately drenched with rain, and burned with drought; or where, as in Central Asia, the general character is dryness. In all places where they are found natives, they are inhabitants of the plains, and not found on mountains, among rocks, or in close forests; neither do they follow the lines of the great rivers, and the rich savannahs, so much as the ox tribe. Their solid feet enable them to bound lightly along hard pastures and sandy plains; and the comparative swiftness of some of the species, and the power of endurance in the others, fit them for ranging over long distances in search of their food. Accordingly, all those which still occur in what may be considered as in a state of nature, are nomadic, or shift their ground with the seasons. They are also, like all herbivorous animals which thus seasonally shift their ground, gregarious in their habits, and generally found in large flocks or droves, usually living in great harmony with each other, though the males, as happens among most gregarious animals, fight desperate battles with each other in the season heat.

Animals of this genus are so very peculiar in their structure and habits, and differ so little from each other, and have so few points of resemblance to any other genus, that it is not easy to say either what are the others to whom they are most nearly allied, or what kind of country or condition of the world is best suited to them. That it should be a state of the country in which vegetable productions are rather abundant, and dry at one season of the year, we may naturally infer; and it is probable that at one period of the earth's history, they inhabited many places in which they are not now to be found. In some points of their characters they resemble the elephants not a little; but they differ greatly from them in others, and especially in the elegance of their forms, and in what is usually termed animal sagacity. They are far from having the same resources as the dog family; and they do not come into such familiar contact with man as to live in the house with him, to follow his footsteps, and to watch and to be influenced by his very looks. But still there is a wonderful degree of tractability in them, and, when properly taught, there are few animals more attached than a horse is to his rider. And though there is a certain degree of stubbornness in the ass, there is perhaps no animal more completely free from vice, or which endures with even half the patience the very extremes of ill-usage.

Thus, though their history as a portion of wild nature, is exceedingly scanty, it is highly interesting so far as it goes. There is another general point worthy of notice; the fossil bones of horses which are dug up in countries which now contain no horses in a state of nature, have been found in accumulations very similar to those which contain the bones of the extinct elephant, and some others of the extinct pachydermata. This leads us to suppose that those other extinct animals must have been co-inhabitants with the extinct horses; and thus, though the evidence is rather imperfect and shadowy, we get at least a glimmering of light upon which to found a belief that the world has, at one time, in our north-western parts at least, been much more a region of pachydermatous mammalia than it is at the present time. Our belief in this is much strengthened when we look at the vegetable remains which appear to belong to the same period, and compare them with the vegetation of those places which such animals now chiefly inhabit. Those remains consist invariably of vegetables of larger growth and coarser texture than those which at present cover the surface in the same places; and, with the exception of the horse in a domestic state, for we really know very little about wild horses, those pachydermata, which are entirely vegetable in their feeding, feed upon much coarser, or, as we may say, rougher vegetables than any of the mammalia, with the exception perhaps of the beavers, and some others of the rodentia which gnaw sticks. We shall now briefly advert to the species.

THE HORSE (*E. Caballus*). As this is the technical species of the genus to which we have chiefly referred in our general remarks, we do not need to repeat any specific characters; and, indeed, the extremes of the varieties, even in our own country, which we may, perhaps, reckon from the Flanders or dray-horse to the Shetland pony in point of size, and from the same to the racer in point of symmetry, are so numerous, that no single description could be so framed as to include them all; for the better that it applied to one, it would be sure to apply the worse to

another. It is, however, well worthy of remark, and shows the general adaptation of the animal tribes to the use of man, that while the less tractable pachydermata have perished from our temperate regions, the horse has remained, and been taken into the service and favour, and we may also say, the companionship of man.

The horse, as it should seem, is an inhabitant of the eastern continent only; no trace of it having been met with as showing that it existed in any part of America, until it was carried there by the European settlers. But in the wide plains of South America, which resemble in many respects those places of the eastern continent, in which wild horses are still met with, the imported ones have been multiplied till they are, perhaps, more abundant there than in any part of the east. Multitudes of the race are found running wild in various parts of the world; but in very many cases, at least, they seem to have descended from domestic generations; and it requires no great stretch of the imagination to presume, that in no country has the species enjoyed absolute independence and freedom. In the southern parts of Siberia, in the great Mongolian deserts, and among the Kalkas, to the north-west of China, they are frequently met with in large herds roaming at will; and they are also found in the deserts on the banks of the Don; but the last are supposed to have sprung from those horses which were turned loose for want of food by the Russians, whilst they were engaged in the siege of Azoph, during their barbarous conquest of the Tartar states to the northward of the Black Sea, which Russian ferocity and zeal for destruction found an Eden and left a wilderness. There are also numbers of wild horses found at the Cape of Good Hope. These are of small size, and, from the vicious disposition they exhibit at the approach of man, they are reckoned almost untameable; it is probable, however, that those animals which have been described as wild horses in this colony, and in some other parts of Africa south of the desert, are a distinct variety, allied to the quagga, and intermediate between that animal and the horse; for the quagga, like the zebra, is a wild and untractable animal, and has not been brought into a state of regular servitude by man. The wild horses of South America, and of the plains to the northward of Mexico, to which we have already alluded, are descended from the Andalusian breed. They were originally conveyed from Spain by the first conquerors. They are most frequently found in the southern districts of the river Plata, as far as Rio Negro, the country of the Patagonians, and the districts immediately adjoining. In these parts they are met in great numbers, some of the herds amounting to not less than ten thousand animals; and each herd comprising many families, the stallion appropriating as many mares as they can, to all of whom he extends his most especial protection. The most prevailing colour of these animals is black; but there are also a sprinkling of bay and dark brown amongst them. Of all the countries in which the horse is found in a wild state, Arabia produces the most beautiful breed. The animals that are met with in these deserts, though not in such large numbers as are found in some other parts we have alluded to, are of superior symmetry and swiftness. The Arabians are solicitous in catching the wild horse, which by their kindness and attention they are not long in domesticating.

It has been very generally believed, that Arabia

was the original country of the horse; and certain we are that there the greatest care is taken to avoid crossing his breed, that the species may be kept entire.

We shall now notice one or two of the most remarkable breeds of horses which are found in different countries of the world, and also a few of those which are of the greatest name in the British islands; but before we proceed to this we may remark that, in our *plate*, HORSES, there are given three remarkable varieties, in order to show the contrast. At the top of the plate there is given the Tartar horse, remarkable for the straightness of the frontal line, the squareness of the nose, the wideness of the nostrils, the beard along the under jaw, the general shagginess of the coat, and the length and quantity of hair in the tail. This appears to be the original horse of eastern Europe, as well as of western Asia northward of the central mountains; for if the figure of its head is compared with those of the horses on the Elgin marbles, or any other Grecian sculptures of undoubted authenticity, there will be found to be a wonderful coincidence: nor are these characters entirely lost in the Shetland pony, shown in the under part of the same plate; and, as we shall afterwards see, there is every reason to believe that this pony found its way to the Shetland Islands through Russia and Scandinavia. In the third variety on the plate, representing a draught or dray-horse, there is a remarkable difference in the outline of the head, which is far more convex than in the other; the body is different, too; for, though larger, it is not nearly so compact, and the animal is less strong in proportion to its size, and far less enduring.

The *Arab* is, in many respects, entitled to take the lead among all the breeds of horses; though it is probably not the most handsome, according to our notions. Its frontal line is straight, or even a little concave; the chest is narrow, and the balance is thrown with great equality upon both sets of extremities. But, the narrow chest, by means of which the fore-legs are brought much closer to each other, though essential to a swift running horse, does not adapt the animal well for draught. In Arabia, and the other countries where this horse is so much esteemed, this is not considered a deficiency, because there the horse is not used for the draught, and goods are conveyed on the backs of camels. The skin of the Arab is very fine, the hair smooth, and the form of the muscles and the positions of the veins under the skin very conspicuous. The joints are particularly well made, and those processes of the bones to which the tendons are attached, are very prominent, and the joints themselves are generally free from any defect. The limbs of Arabian horses are particularly handsome; and they have little or no hair on the fetlock. The common height at the shoulder is, in general, rather more than four feet and a half. The height of horses is, however, usually estimated in hands—a hand being reckoned four inches, or three hands to a foot; so that the usual stature of the Arab is between thirteen and fourteen hands. The pace of these horses is rapid and graceful; they do not perspire much; they last a long time; they can continue travelling at the rate of from fifty to sixty miles a day; and five or six pounds of dourra, or the barley of that country, in the evening, is a sufficient feed for them. When at home in the tent, they are fed with barley-straw, chopped short, which is something like our cut-chaff, but more

rudely prepared. The wind of these horses is particularly good; and they can be pushed at their full speed for a long distance without injury to it. They carry their heads, and also their tails, in a very graceful manner; the position of the latter is often tried to be imitated in this country by means which are equally clumsy and barbarous. As is the case in this country, the horses of Arabia are divided into ignoble and noble—the former being doomed to drudge, while the latter are used for the saddle, highly esteemed, and much attended to by their owners. They call the former by a name which means, “without pedigree;” and the latter another name, which signifies a pedigree, which would be venerated even in the Principality—“Known for two thousand years.” The tradition is, that those horses are descended from the veritable stud of King Solomon, and have not been once crossed or corrupted in the blood since he sat upon the throne in Jerusalem; but, be that as it may, they are unquestionably noble animals, held in great esteem, often of enormous price; and we may suppose that among a people so romantic and so poetical in their language as the Arabs, the most wonderful stories are told concerning them. “If,” says the Arabian story, “you meet one of the faithful in the desert, mounted upon a *Kochlani*, and he shall say ‘God bless you,’ before you can say, ‘and God’s blessing upon you,’ he shall be out of your horizon, for the whirlwind toils after him in vain.”

The utmost attention is paid to the breeding of these horses, that they may not be tainted even by accident. The coitus always takes place in presence of a witness, who remains twenty days afterwards to watch the female. The same witness is also present when the colt is cast, and a regular certificate is made out within the first seven days. If these circumstances are not attended to, and the legitimacy cannot be established by the proper certificate, the marketable value of the horse is greatly diminished, whatever may be his real qualities as an individual; and contrary to the custom which takes place in the rearing, at least of half-bred horses, in many parts of this country, as much attention is paid to purity of blood in the female as in the male. The best horses are understood to be bred by the Bedouins of the north part of Arabia; and, though the horses often fetch an immense price, the genealogy is invariably reckoned from the mother. This is at least one of the reasons why the Arabs are so careful that the noble mares shall not be contaminated by the ignoble horses. It is not possible in all cases to prevent an occurrence of this kind; but when a cross does take place the colt loses caste, and is considered to spring from the father which has no pedigree. On the other hand, an improved cross breed between the noble horses and the ignoble mares is very frequently encouraged; but in order that the progeny in this case may not be confounded with the true blood, it takes the designation of the mother; and how much soever it may be improved, it is still ignoble. The Arabs in many instances breed horses for sale to the people of other nations; and those of the pure blood are more readily and cheaply obtained from the people about the towns than from the tented Arabs of the wilderness; for the latter have a strong affection for their horses, and will hardly part with them at any price. It sometimes happens, however, that there is an unlucky mark upon the horse, which really does no harm except to the superstitious feelings of the owner;

and when it is ascertained that any Arab is in possession of such a horse, it may be had for a small fraction of the price which would otherwise be set on one of the same intrinsic worth. Crossing with Arabian horses improves every other breed of the horse, whatever may be the size and character; and for crosses of this kind the stallion is invariably preferred. This is of some advantage independently of securing, as it is understood to secure, a better progeny; for it leaves the mares in Arabia, where they are much more scrupulously attended to than they would be in almost any other country; and as the increase of the race depends more on the number of mares than on that of horses, the leaving of the former in the country enables many more to be bred. In crossing by an Arabian, or “barb,” as it is sometimes called, as being first introduced into Spain through the states of Barbary, the first progeny always partakes of the good qualities of the Arabian; but if the other branch of the cross is very different from an Arabian in appearance, the form of the progeny is often ungainly in the immediate generation. But, upon a principle which we cannot very well explain, the succeeding generations improve in symmetry, and do not fall off in the spirit and other good qualities of the first cross. Thus a horse may be bred with any fraction of pure blood in him, and render at the same time a spirited and handsome horse for any purpose, except the most rough and heavy ones. We have already said that the essential character of the Arab is not that of a draught horse of any description, and therefore if mere strength of draught be the object it cannot be improved by this species of crossing.

The Persian horse is evidently a cross with the Arabian, but in which way or with what breed it is not easy to say. According to our notions, its head is rather handsomer than that of the Arab; and it is a more weighty animal, but it wants the spirit and continuation of exertion which are so characteristic of the other. For short distances, these horses are nearly, if not altogether, as fleet as Arabians, but they have not equal wind. The Persians, however, pay great attention to purity of blood in their best horses; and in former times the horses of this country were much improved by the introduction of some stallions from Persia; and the race, bred by crossing with these, was once greatly celebrated for its swiftness on the turf; though, since the real blood was introduced, our swift horses are vastly superior to what they were then.

The Turkish horses resemble the Arabs still more than the Persian ones; and they are used almost solely for the saddle.

The Barbary horses appear to be a cross with less Arabian blood than either the Persian or Turkish. They have the line of the head convex, and the chest broader; and thus they are not so well adapted for swift running as the Arabs; but they are showy horses, and understood to be very docile. Their general height is about fourteen hands.

The Tartar horse to which we have already alluded appears, from all the accounts we have of it, in the different districts which are inhabited by the various Tartaric hordes. It is, however, very general in central Asia, and in the south-east of European Russia, where the breeds differ a good deal according to the nature of their pasture and food, and the kind of treatment they meet with. Their forehead, as already observed, has still a good deal of the Arabian

straightness of outline ; but the shagginess of their coat points them out as natives of northern and central Asia, where this is a common character of very many of the mammalia. Their origin is not exactly known, but the probability is that they are originally the same race as the Arabians, only changed by a difference of climate. In all these varieties they are excellent animals, moderate in their feeding, and almost unwearied in their strength. The horses of the Cossacks, and indeed most of those in northern Europe, keeping to the north of the Baltic, appear to be more or less related to this breed, though, as we come nearer the shores of the Atlantic, they do not appear to be quite so shaggy, at least in their summer clothing.

On the continent of Europe there are considerable differences, those of the south partaking more of the Arab character, and those of the north more of the Tartar. In general, they are of light make, but hardy ; though in the flat countries adjoining the North Sea they are very heavy, powerful for temporary efforts, but short-winded, and therefore incapable of prolonged exertion.

We shall now just name one or two of the leading breeds of horses which are found in this country. Of these the first, at least in the sporting world, and in respect of price, is,

The Race-horse. The English race-horse, which, though far inferior to the Arab in point of endurance, is perhaps the finest horse in the world for moderate heats, such as those on the common race-grounds in this country. They are called blood-horses ; but that does not mean that they are pure Arabian blood, on the other hand they are all crosses with English mares, by which means they get an additional strength of bone, while they get spirit from the other branch of the cross. In order that a racer should be "first blood," as it is called, or the nearest possible to the Arab stock, its original descent should be a cross between a pure Arab and a mare which is the produce of a similar cross ; but this is often less attended to than the character of the particular parents ; and the pedigrees of these horses are far shorter than those of the horses of Arabia.

The Hunter is the English horse which ranks next in blood to the "high-mettled racer." The father of this horse is not an Arab, but one of the first blood ; and the mother is one degree further removed from the pure blood than the mother of the race-horse. This horse possesses many excellent qualities, having more bone and power than the race-horse, and also more capacity of continued exertion, though inferior in his speed for a momentary effort. The symmetry of this horse, according to our notions, is perhaps superior to that of the race-horse, because it has a fuller chest, a more concave line in the forehead, and is altogether better filled up and rounded:

The Roadster is half a cross, or a whole cross further removed from the true Arabian blood than the hunter ; but, according to our common notions of beauty, it is perhaps a more handsome horse, plump, round, and of graceful figure and action. But in consequence of its further removal from the true Arabian type, it is much more liable to be influenced by the character of the mother ; and both its beauty and its value depend much more on that branch of its parentage. Hence in the breeding of these horses, and in those further removed from the blood, by which the blood of the male parent is always meant, much greater attention should be paid to the qualities of the brood

mare ; and it is owing to want of attention to this particular, that so many of our horses of comparatively low blood are so ragged in their forms and so coarse in their manners.

These are the principal horses employed in these kingdoms for sport and for speed ; and in many of them a great degree of size, symmetry, and beauty are combined, both for the carriage of private individuals, and for coaches on the high-roads ; the studs for which latter purpose, that are in the hands of first-class coach proprietors, containing, all points considered, some of the finest horses in the world. We shall now mention one or two of the races which are more remarkable for their qualities as work-horses only, or for their small size and great hardihood,

The Dray-horse. This is the largest horse which is found in the country. It is a portly animal, and capable of powerful effort for a short time ; but it is not a good winded horse, and on that account it is wholly unfit for continued exertion. It is understood that the first importation of this horse was from Zealand—though the females are styled "Flanders' mares," by which name Henry VIII. was pleased to designate Anne of Cleves, one of his royal consorts ; and it is said, that allusions have been made to the same epithet in later periods of our history. Horses of this breed are sometimes known by the title of "fen horses ;" and though they are like most of the domesticated varieties, liable to break into different colours, and are not unfrequently iron-grey, or even pie-bald, yet the prevailing colour is black. They are more abundant in London than in any other part of the country ; and they are chiefly used in brewers' drays and other carriages, where a very heavy load is dragged along with frequent stoppages. They are unwieldy ; but, the entire horses especially, have very well-formed necks and ample chests ; and, if their great size is taken into account, their forms do not want symmetry. There is a great appearance of power about them, but the reality does not come up quite to the appearance ; and they are deficient in spirit. They are, however, very showy animals ; and in some parts of the world they are highly prized. They are particularly so by the rulers of the native states of India, who, like other semi-barbarous people, esteem them as the chief element of power ; and upon a late occasion, when lieutenant Burnes was sent on a mission to appease the wrath of Runjeet Singh, the sheikh-chief of Lahore, dray-horses were considered as the most acceptable present that could be presented to that personage. In that part of India they are known by the style and title of English elephants ; and Runjeet Singh was so much delighted with the ponderous brutes, that he addressed to the British governors of India a letter, expressing his admiration of the animals themselves, and stating that the *sheen* of their ample shoes was so splendid, that the moon had been puzzled as to whether it should or should not enter into competition with them, and venture to shine after their arrival at Lahore.

Some of our own writers upon live-stock have expressed very different sentiments on the subject of these horses. "The breed of grey rats," says Marshall, in his History of Yorkshire, "with which this island has of late years been overrun, are not a greater pest in it than the breed of black fen-horses ; at least while cattle remain scarce as they are at present, and while the flesh of horses continues to be rejected as an article of human food." It is to be understood, how-

ever, that Mr. Marshall is speaking of the general economy of the country, and with the view to having common horse-work, in agriculture and conveyance, conducted in the most economical manner, and in accordance with the means of obtaining the greatest supply of all kinds of farm produce, and using it in the most economical manner. In this point of view Mr. Marshall does right; for the dray-horse is a horse fitted only for very particular services; and from the great quantity of food which he consumes, as well as from the shortness of his wind, and the consequent frequency of rest which he needs, he would be the most unprofitable horse that the farmer or the carrier could possibly keep. Even in his appropriate situation, that of a London brewer's dray, he is really almost as much an animal of show as of use; and though the momentary pull that he can take, and his power of starting a heavy load, which power he derives from his weight, are probably greater than those of any other breed, yet for continuance of work he is certainly inferior.

It is understood, however, that crossing between this breed and the "rips," or ragged horses, which are used in the country, and accustomed to stand all weathers, produces a breed possessing part of the weight of the one, and much of the hardihood of the other. The horses employed in drawing coal-waggons and other heavy carriages about the streets of London, where the traction required is great, and requires mass in the horses, and also continues and requires wind, and bone and sinew rather than fulness of flesh, are understood to be about the nearest cross to the dray-horse in this respect; and when we get to the waggon-horses, which ply constantly in slow draught along the roads, and creep on for very long distances without halting, we get a nearer approximation to the common country breed, until at last all traces of the dray-horse are lost, and we come to an animal which can endure all labour, and stand all weathers, but which, at the same time, is by no means handsome, neither is it very effective at a short dead pull. It may be of use to some of our readers to present them with a list of the characters of a first-rate horse for agricultural purposes, as given by Mr. Culley, in his treatise on live stock. "His head should be as small as the proportion of the animal will admit; his nostrils expanded, and muzzle fine; his eyes cheerful and prominent; his ears small, upright, and placed near together; his neck, rising out from between his shoulders with an easy tapering curve, must join gracefully to the head; his shoulders being well thrown back, must also go into his neck (at what is called the points) unperceived, which perhaps facilitates the going much more than the narrow shoulder; the arm, or fore thigh, should be muscular, and tapering from the shoulder, met with a fine, straight, sinewy, bony leg; the hoof circular and wide at the heel; his chest deep, and full at the girth; his loin or fillets broad and straight, and body round; his hips, or hucks, by no means wide, but quarters long, and tail set on so as to be nearly in the same straight line with the back; his thighs strong and muscular; his legs clean and fine-boned; his leg-bones not round, but what is called lathy, or flat."

There are several breeds of named horses, which are conspicuous for their superior usefulness in harness, either as coach horses or for farm-work, among which we may notice

The *Cleveland Bays*. These are, perhaps, the

most handsome working-horses in England, and, indeed, in the world; though it is alleged that of late years they have fallen off. When pure they contain a certain fraction of the blood of the race-horse in them, and, by necessary consequence, some of that of the Arab; but they are strong and hardy, as well as exceedingly active. A pair of them are heavy enough for drawing a two-horse plough in all but the very stiffest lands; and as they step well out, they turn the furrow with more rapidity than almost any other horses; while their wind is excellent, they can continue long at work, and their keep is not very expensive. In ordinary draught, three of them have been known to pull a ton and a half over sixty miles' distance in the twenty-four hours, without requiring any rest except three moderate feeds in the course of the journey. In the plough, the labour of a pair, on the average, for continuance of days, is about an acre a day, which occupies nine hours, in two *yokings*, morning and evening, with a rest at mid-day; and substantial food, of which the quantity requires to be smaller than if the quality were inferior, is by far the most economical; as upon such food the horses will do more work with less fatigue, keep their health better, and last much longer. It may not be amiss to mention, that the entire length of furrow in one acre is rather more than eleven miles and a half so that they pull the plough along, and turn the furrow at the rate of more than a mile and a quarter in the hour, or, making allowance for turnings, about a mile and a half at full swing; and if the land is free and light, an excellent pair, with a clever ploughman, will "slice away" at the rate of two miles an hour; and with such horses, and a swing plough of the best construction, the same quality of land may be turned in finer style, at less than half the expense that it can be turned by the team of "ragged-rips," and the lumbering wheel-plough, which is used in too many parts of the country. Every one who employs horses in working, ought to know that the greater the number employed to any one draught, the greater the loss of power upon each horse, because it is impossible for any training to make them all pull together; and if the number is above five or six, or even as many, it is perhaps not too much to say, that the entire labour of one horse is lost. In those clumsy teams, too, which crawl like snails along the road or the furrow, there is a great mechanical disadvantage, which is avoided by more light and lively working. Every one knows that much greater power is required to start any motion, than to keep it up after it is started; and as they creep along, the whole may be said to be a succession of starts, and these starts, in a great measure governed, by individual efforts.

On the other hand, when a well-matched pair move onward, keeping step as truly as a file of grenadiers, both shoulders are constantly at their bearing, the plough or the wheel acquires a momentum; and so little do the horses feel it, if they be well chosen and properly attended to, that they will do equal work to four of the others, without a turned hair at the end of it. Nor is the beauty of this superior style of ploughing by any means to be overlooked; for if the work is elegant, a portion of the elegance will be imparted both to the workman and the looker-on. Where the land is laid out in breadth, with belts of planting between, hills rising beyond, and the fertilizing river sweeping, or the sea breaking in gentle ripples to the

fresh morning air, at the bottom of the slope ; and where it is the custom to squad the ploughs so that they move along in an oblique line, the one a little behind the other, as regular as the divisions of an army marching in *echelon*, there is not a finer sight in the whole compass of human occupation, or in all the countless charms of a country which combines the grand elements of peace, plenty, power, and worth : and upon such occasions, the well-tuned whistle of the ploughman, which is such favourite music in the ears of the horses, has more natural, and more moral melody, than all the instruments that ever were played in an orchestra.

The different coach-horses used on the roads are generally of this breed, though with a little more blood, and therefore a little lighter than those which are most efficient for agricultural purposes, and other operations of comparatively slow draught. The fast coaches have horses still lighter, and of course with still more blood. They approach in many respects to the hunter ; but when the spirit and speed can be found combined with a good deal of bone and strength, the combination produces a coach-horse of the very first quality. This race of horses is purely English in its breeding ; and though many of them have been exported of late years, especially to France, they are nowhere found in such perfection as in their native country ; this is no doubt partly owing to the superiority of the roads, and partly to the better management of the horses.

The *Suffolk Punch* is a most excellent horse for agricultural purposes, and it is very much used, not only in the county after which it is named, but in other parts of the country. It is rather short in its dimensions, and it wants the elegant gait, and some of the beauty of form, which characterise the better varieties of the breed last mentioned ; but it is remarkably compact, firm, and strong, and good winded, so that it can continue a long time at work. Suffolk punches will perhaps do as much agricultural work in a day as any horses which are employed in agriculture, and will continue it for as many days in succession, but they will require a longer time each day. We must again refer to Culley for a description of this very excellent and valuable breed of horses. " Their colour is mostly yellowish or sorrel, with a white ratch or blaze on their faces ; the head large, ears wide, muzzle coarse, fore-end low, back long, but very straight, sides flat, shoulders too far forward, hind quarters middling, but rather high about the hips, legs round and short in the pasterns, deep-bellied and full in the flank. Here, perhaps, lies much of the merit of these horses ; for we know, from observation and experience, that all deep-bellied horses carry their food long, and, consequently, are enabled to stand longer and harder days' works. However, certain it is that those horses do perform surprising days' works. It is well known that Suffolk and Norfolk farmers plough more land in a day than any other people in the island, and these are the kind of horses used everywhere in those districts." These horses are very efficient, not only in Low Suffolk, or the sea-coast district, which is light and sandy, and kept in heart in a great measure by shell marl, which makes a free soil, but also in such parts of High Suffolk, or the stiff clay district, which occupies the central and largest portion of the county. Very much of this portion, however, is laid down in pasture for cows.

The *Clydesdale Horse* is one of the best breeds in Scotland for farming purposes, and has been long in request both in the Lowlands of Scotland and in the north of England. The origin of this breed is very imperfectly known ; and though they are called Clydesdale horses, it appears to be more from the markets at which they are purchased lying in that district than from anything else ; for they are very generally used, and also bred, in all the western and midland parts of the Lowlands. They are rather larger than the Suffolk punches, have the neck longer, and step more out. The chest is full and broad, the shoulder thick, the blade-bone rising up to the chine, and not sloping so much backwards in its anterior edge as in the fast-going road-horses. The hoof is round and firm, usually black, or of a deep horn colour, and the heels are wide ; the back is straight and broad, but not long in proportion to the weight of the horse, which gives real as well as apparent compactness ; the hucks do not stand much out, and the space between them and the ribs is short ; the tail is firm, and finely supplied with hair, and the buttocks come so close together as to leave a small furrow for it. These horses are of different colours, but the usual ones are black, brown, and grey, the latter being often beautifully dappled. They are not liked, with a full blaze of light in the face ; but a small spot in the forehead, called a " bell " in some of the districts, is considered so great a beauty, that it is often at least tried to be produced by artificial means, and the dealers colour it for the market. Those horses are strong, hardy, good tempered ; scarcely one of them is restive ; and they lay their shoulders fully and fairly to the draught, and perhaps pull better together than any working horses in the kingdom. It is somewhat singular, however, that the district after which they are named is far less famed for its ploughing than for its horses ; at least the writer of this article never saw a furrow in Clydesdale that would have passed muster at a ploughing-match on the east side of the island.

Such, in brief outline, are the principal breeds of horses in the more improved and fertile districts of the British islands, though of course there are local varieties without end. There still remain some smaller breeds, more nearly in a state of nature, which deserve notice. One of them is

The *Welsh Horse*, or *Ceffal*, which some suppose to have been an importation by the Romans, and therefore to have a good deal of the blood of the Tartar horse in it. This horse is not large, neither is it handsome, and upon level ground it is not a swift horse. Still, however, it has its good properties. It is exceedingly hardy, patient of fatigue, by no means destitute of spirit, remarkably durable, and, generally speaking, very tractable. Then, it is a very goat upon the rocks, actually preferring them to softer footing ; and, be the ascent or the descent ever so steep and rugged, if the rider can maintain his seat, the ceffal is sure to keep its footing ; for in this respect, both in firmness of hoof, and in skill in the planting of it, it is little, if at all, inferior to the mules used in the Andes. For cliff-riding, however, the ceffal must be allowed to have completely his own way ; for any attempt on the part of the rider to guide him in a pathless place of difficulty would be attended with hazard to both. It is told of a Welsh gentleman, who was in the train of one of the kings of England, mounted on a charger from his native hills, that,

when the king reproached him for being last in at a riding, he replied, "Hur is as coot a shentlemans as the pest, but hur ceffal is only a shentleman on the rock, and let them try a riding there." For those who require to be much on horseback, superintending workmen, or doing anything else which does not require fast riding, a ceffal is worth all the fine horses in the world, both for comfort in the use and for durability; and then, as to footing, one of the true breed will get upon hard stones, if he can, in preference to turf. The Welsh name *Ceffal*, like the French name *Cheval*, is obviously derived from, and indeed identical with, the Latin *Caballus*; and this is a strong proof that the horse was introduced into Wales by the Romans. An additional proof of this is found in the fact, that the people of the north of Scotland, who speak a dialect of the same language as the Welsh, do not give the horse any name at all resembling the Latin, but apply different names to it in different parts of the country, clearly showing that it has been introduced into different places by different nations and at different times.

There are many breeds scattered over the wilder districts, in various parts of the mainland of Britain, and also in the isles, which differ considerably from each other, being, in some instances, exceedingly small, scarcely larger than Newfoundland dogs, and in others of considerable size. Some of these are very rugged in their appearance, and others are very handsome; but they all have a great deal of spirit and strength in proportion to their size, and they are remarkably abstemious in their eating. On Exmoor, south of the Bristol Channel, they are found completely in a state of nature; and we believe that, in some instances at least, they are not considered as property. These are generally very handsome little animals, with the legs slender and beautifully formed; and, when properly trained and broke, and rightly used, they are gentle and docile, and not so apt to shy and be skittish as the horses of the north. For very light weights, or very light carriages, when well matched, they are pretty little creatures; and, as the burden of their own flesh which they have to carry is very light, they can do more work, and continue longer at it, than one would suppose, if their size only were considered.

In the south-west of Scotland there is another breed, rather larger than these, but still handsomer in the limbs, and remarkably hardy and sure-footed. They are usually called Galloways, from the district of which they are natives.

In the southern part of the Western Islands, and more especially in the Island of Mull, there is a very fine breed of these small horses; and these have been largely introduced into the mountainous parts of the main-land. These are the Highland horses, properly so called, which have very shaggy coats, and get pot-bellied, when much exposed to the severity of the weather, and scantily supplied with poor food; but with proper treatment, their appearance is very different, and their qualities are superior, while they can live well in places where the large horses of the low-country would starve. They appear to run gradually into smaller and more shaggy breeds, as we get more northward in the islands; and when we get to Shetland we meet with the very small ponies, to which allusion has already been made. They are found, also, in the Faroe Islands, in Iceland, in Norway, and in the upland parts of Sweden; and as

they all have less or more of the character of the Tartar horses and more of it the farther north they are found, we have as clear a proof as such a subject admits of, that they have come originally from that part of the world, and been introduced into the islands on the north and west of Scotland by the Norwegians, when they were in possession of them.

As to the superiority of the breeds, at the two or three points to which we have alluded, there have been various conjectures, even before it was fully ascertained that no breed of domestic animals can be substantially improved without crossing. The Tartar horse, which, we think, circumstances point out as the ancient parent-race of the whole, is rather a thick-legged horse, or at all events the legs are stout; and it is contrary to the whole system of animal economy, that an animal with thick legs should be a very swift goer. We know that the thin legs and speed of our high-breed horses were procured by means of crossings with the Arab; and we know of no other means by which such a change could be brought about. It is, therefore, highly probable, that those handsome horses with thin legs are the progeny of the native mares by Arabian horses, cast ashore from the wreck of different vessels of the Armada; for it is pretty well ascertained that, in the disastrous rout of that vain-glorious equipment round the island of Great Britain, some ships were wrecked on the coast of Mull, others on the coast of Galloway, and there were, probably, others wrecked on the south coast of the Bristol Channel, which would account for the fine limbs of the Exmoor ponies.

Having now taken a short glance at some of the different breeds of horses in the several localities of Western Asia and of Europe, and noticed, more particularly, those of the British Islands, we are now in possession of the elements of at least a very rational theory of the emigration of those most useful and interesting animals. Whence the Britons obtained those horses which they had in their war chariots, during their contests with the Roman invaders, we have no means of ascertaining which are perfectly satisfactory; but as it is well understood that there was a trade between the south of England and the Levant at an earlier period than this; and as there was commercial intercourse between the south of France,—either the present Marseilles, or some town near the same spot,—and the countries both to the east and the south of the Mediterranean, at a period still earlier; it is highly probable that horses might have found their way by those channels into the south of Europe, and as far as South Britain. Indeed, it is difficult to suppose that such was not the case, for if there was a friendly intercourse between two nations, the one of which possessed the horse, and the other did not, it must have followed, almost as a matter of course, that they who were without this animal should stipulate for it as one of the articles of exchange. It does not appear, however, that at this period the horse was generally known, or, indeed, known at all among the Welch mountains; for the Roman name of the horse there, which is general over all the principality, clearly points to the Romans as having introduced it there. Here the question gets a little embarrassed with the question of the human race, in the two parts of South Britain, and would lead us to suppose that, long before the time of the Romans, the low country of England was peopled by a race quite different from the Welch; and

that upon the Saxon invasion, the Britons did not escape to the Welch mountains, any more than, upon the Danish and English invasions, the Scotch lowlanders fled to the highlands. The probability is, that in either case they would have been escaping from Scylla to fall upon Charybdis; but the point, though necessary to be mentioned, and well worthy of investigation, does not properly fall within our present subject.

We are to understand, therefore, that at very early times there was a bringing of horses from the Levant and the adjacent countries into the southern states of Europe; and that those horses were all brought from countries to the southward and the westward of the Caucasus, the mountains of Armenia, and of Asia Minor. So, also, in the gradual migration of the hordes of central Asia, westward into the valley of the Danube, and so into Germany, and along the north of the Carpathian mountains, through Russia and Poland, into Denmark and Scandinavia, there was a migration of Tartar horses, which ultimately found its way as far as the Norwegian *Vikingr* extended their excursions.

Thus we are to understand that horses were originally imported into Europe by two channels, one in the south and the other in the centre; for though we may suppose that there was something analogous to this on the line of the Danube, yet the connexion between this line and the shores of the North Sea was, at that time, very much, if not altogether, interrupted by the dense forests in the central parts of Germany.

The southern importation, being of a stock of horses from near the country of the Arabs, may be regarded as having partaken a good deal of the Arabian character, while those of the north were more allied to the Tartar breed, as at present found in the south of Russia and in central Asia.

Thus we are brought to at least not more than two original races, one to the south of the mountains which divide Asia in latitude, and the other to the northward of the same.

The characters of those two races, as they now exist in the two countries, beyond which we cannot trace them, may or may not be climatal varieties of one single parent stock: but the probability is that they are. The race of the south are remarkable for beauty and fleetness; and those of the north for strength and protection from cold in the thickened hair with which their bodies are covered, as compared with the others. Now, when we look at other races of animals, we find that the species which are adapted for fleet motion over long distances, and by that means the best fitted for an extended range over deserts but thinly spotted with anything upon which the animals can subsist, or plains which are subject to seasonal periods of barrenness in consequence of the heat of the sun and the dryness of the air, have the legs long and slender; while, on the other hand, those which have to walk among rocks, to climb hills or dwell in rough and miry places, have always the legs much stouter; so that though they do not admit of such rapid motion, yet the animals can stand more firmly upon them, and use the individual foot with more power for a single exertion. This circumstance did not escape the penetrating glance of Burns, the Scottish bard, for he makes use of the expression—

“Muirland rams,
Wi’ woo’ like gaits, an’ feet like trams.”

He does not, it is true, use the expression with any reference to the point which we wish to establish; but then this makes his evidence all the more valuable. Now these characters of the Muirland sheep, against which the subject of the poem is understood to be cautioning her progeny, which of course mean, “wool as coarse as the hair of goats,” and “feet as thick in proportion as the shafts of a cart,” are the very characters in which the northern, Tartaric, or hill and bog horse differs from the southern, Arabic, or wide and dry pasture one; and if we find this difference between the characters of horses, and a parallel case in the matter of sheep, we perhaps get as near to demonstration as such subjects will admit of, that the thick-legged, strong-bodied, and comparatively slow horses are descended from the Tartar breed, while the clean-limbed, narrow-chested, and fleet horses are all from the south. It is doubtful whether we have in western Europe any breed of horses, comparatively in a state of nature, which can be considered as Arabians, only altered by climate; but there is little doubt that the Shetland pony is the final stage of diminution in the Tartar horse, with the blood pure; and this is confirmed by the resemblance in the shape of the head, and in many points of the character of the two, for the Shetland pony has really more of the peculiar vigour and inexhaustibleness of the eastern horse, than those handsome ponies which are understood to have Arabian blood in them.

The only other point which remains, worthy of much inquiry, is from what origin the great dray horse, usually called the Flanders horse, has been derived. The thick legs, long fetlocks, square chest, and heavy body of this horse, forbid all possibility of relationship between it and the Arabian, and therefore we must have recourse to the other origin. Now the horses of Holstein, and of all the richer parts of Germany and the Netherlands, near the shores of the German Ocean, are of this character; and they are always larger and heavier in proportion as the country is lower and richer in its surface; and if the severity of the climate, and more especially the poorness of the pasture, could on the one hand reduce the Tartar horse to the small dimensions of the Shetland pony, it is quite natural to suppose that, on the other hand, the opposite kind of feeding might bring it up to the volume of the dray horse. We know that both the Saxons and Danes invaded England and the Lowlands of Scotland from countries where, in part at least, such horses might be expected, from the modifying influence of climate and pasturage alone; and, therefore, while we see the Tartar horse has been carried by the northern route to Ireland, peopling the whole of the north with little hardy ponies; so the Danes and the lower Saxons carried to Britain, and the countries farther to the south, the parent stock of all those working horses of the British Islands, and the adjacent parts of the continent, which are of heavier make than the Welsh cefal, which, as we have said, may be considered as the breed principally introduced by the Romans. The dray horse may be considered the extreme of this breeding in size; and from what we have said of the incapacity of these heavy horses for continued exertion, it is obvious that for general purposes it has been carried beyond the point of maximum value, by more having been lost in time than has been gained in power.

Such is the history of the horse, in brief outline, viewing that animal as an isolated member of animated

nature, and as accompanying man in his migration over different regions, or as spread into places where previously unknown, by the intercourse of one nation with another. But the horse has another, and in so far as we can predicate morality in a creature endowed with an immortal spirit, a moral history. Many animals live in a state of perhaps more close domestication than the horse does ; and the dog especially, being one which in a state of nature requires more art and stratagem for finding his food, is capable of evincing his attachment to his master in a greater variety of ways. The dog will fight for his master, will fawn upon his master, and will watch and defend his master's property, with a fidelity perhaps unequalled by the human race. The horse does not fight of himself, for his nature is the very opposite of pugnacious ; the horse does not fawn, for the spirit of the horse is noble ; but the horse, if the expression may be used, stands to his rider more in the relation of a companion and equal, than any other animal stands to man. There is, also, in the gratified look, the erected ears, the arching neck, and the subdued and murmuring neigh of the horse, at the sight of that rider with whom he has been long associated, something more touching, or if you will, more poetical, than in the fawning of all the dogs in the world. Then there is no danger which the horse will not brave along with his rider ; and on those occasions man very often borrows courage of the spirit of the animal. In the darkness of night, when the traveller knows not his way, and would be incapable of reaching his home, his faithful horse will carry him in safety through the most difficult places ; and be the path ever so intricate, and the obstacles ever so many, if the rein is entirely given up to the horse, not a foot of his will slip or be misplaced on the most difficult ground, and not one of the obstacles will he come in contact with. This is a curious point in physiology, but it is as true as it is worthy of admiration. The firm and entire hoof of the horse, even when shod with iron, seems to acquire in the dark a sense of touch equal to the most delicate finger ; and though we cannot account for it, every hair upon the skin of the animal appears to be instinct with all the senses necessary for guiding him along, with the same certainty as though it were clear daylight all about him. If the horse and the rider have been long acquainted with each other, and have frequently made nocturnal journeys, it is of no consequence, if the journey is a homeward one, whether the rider pays the slightest attention to the matter or not ; for there have been many instances in which an old and trusty horse has carried his rider asleep for a distance of more than twenty miles. There have been also instances of favourite ponies carrying blind musicians from house to house for the purpose of giving lessons ; and indeed it would be impossible to enumerate half the instances which are well authenticated, of quiet and slow-going horses finding and keeping the way without any assistance from their riders ; and the same applies to horses habitually used in draught.

The case of horses of higher mettle, though not more extraordinary, is more spirit-stirring ; and it is impossible not to be struck and pleased with the expression of glee in hunters at the morning muster, and especially at the notes of the horn ; and if the chase is long and lagging, the winding of the horn will spirit them up, and they will spring forward as if endowed with new life.

It is in the battle-field, however, that the horse appears in the full grandeur of his character. His neck is clothed with thunder : " the glory of his nostrils is terrible. He paweth in the valley, and rejoiceth in his strength ; he goeth out to meet the armed men. He mocketh at fear, and is not affrightened ; neither turneth he back from the sword. The quiver rattleth against him, the glittering spear and the shield. He swalloweth the ground with fierceness and rage ; neither believeth he that it is the sound of the trumpet. He sayleth among the sound of the trumpets, Ha, Ha ! and he smelleth the battle afar off, the thunder of the captains, and the shouting."

Such is the description of the horse in battle, as given by the great Legislator of the Jews, at least three thousand three hundred and sixty years ago ; and even now that the instruments of war have been rendered more powerful and terrific than they were at the time when this description was written, the horse still exults in, and appears to enjoy, the battle-field as much as ever.

The invention of gunpowder has invested the modern battle-field with all the attributes of that thunder which the ancients regarded as being possessed only by the chief of their gods ; but even this, after a very little training, has no effect upon the war-horse further than to excite his courage, and make him more brave and bold amid the augmented terrors. Roaring artillery, sheeted flame, curling smoke, gleaming steel, rolling drums, sounding trumpets, and all the sights and the din of the hottest conflict, never affect either the courage or the coolness of the veteran charger. He will bear his rider as willingly up to the cannon's mouth, or to, or even on, the point of the lance, with the same cheerful obedience as if he were riding to a field of the richest pasture ; and though beaten back, and smarting with wounds, he will return again and again to the charge ; nor will he quit his duty until he has made the final sacrifice ; and his bones are gathered to the unseemly heap in which horses and their riders lie promiscuously together. But it is only while there is a rider on his back that the horse continues thus obedient to his duty ; for when the ranks are broken, and the riders gone, horses may be seen careering over the field, as if absolutely in quest of new riders to bring them again into action ; and it is said that, upon these occasions, the horses rarely, if ever, trample upon the bodies of the wounded or the dead, with which the field is scattered. If a trumpet sound, too, the riderless horse, if not frantic with the agony of wounds, will follow upon the sound, but will turn away again if he finds that the uniform of the party is not like that of his own regiment. If his rider falls, when the horse is at considerable speed, the horse instantly stops, so that an exchange is frequently soon made of a rider who has lost his horse, and a horse that has lost his rider. Veteran horses are rarely, if ever, panic-struck : and though they are, of course, liable to be taken prisoners, they never desert to the enemy. Indeed, though war is a trade which every one must wish to see abolished, except those who remain at home and gratify their ambition, or other lusts, by the hardship and death of their fellow-creatures, yet, as the characters of the horse in battle are all virtuous without the least mixture of vice, his military glory is as spotless as it is great.

Many anecdotes are told of the strong attachment shown by particular horses to particular riders, with

whom they have been long associated. Of these, some are in all probability exaggerated, but still enough remains to show that those animals are capable of strong attachment and warm gratitude for kind usage; and there have been instances in which a reduced and degraded horse, after plying for years at hard drudgery in the streets, has recognised at once his former military associate, and followed him like a dog.

The most remarkable fact of the whole matter, however, is the evident fondness which horses that have been accustomed to it have for the army; and this appears both in their fondness for particular regiments, and in that for all military array, and even military weapons. It is told that, in one of their insurrections in the early part of this century, the Tyrolese captured fifteen horses belonging to the troops sent against them, and mounted them with fifteen of their own men, in order to go out to a fresh rencontre with the same troops; but no sooner did those horses hear the well-known sound of their own trumpet, and recognise the uniform of their own squadron, than they dashed onward at full speed, and in spite of all the efforts of their riders, bore them into the ranks, and delivered them up as prisoners to the squadron. If an old military horse, even when reduced almost to skin and bone, hears the roll of a drum, or the twang of a trumpet, the freshness of his youth appears to come upon him; and if he at the same time gets a sight of men clad in uniform, and drawn up in line, it is no easy matter to prevent him from joining them. Nor does it signify what kind of military they are, as is shown by the following case. Toward the close of last century, about the time when volunteers were first embodied in the different towns, an extensive line of turnpike road was in progress of construction, in a part of the north. The clerk to the trustees upon this line used to send one of his assistants to ride along, occasionally, in order to see that the contractors, who were at work in a great many places, were doing their work properly. The assistant, on these journeys, rode a horse which had for a long time carried a field officer, and, though aged, still possessed a great deal of spirit. One day as he was passing near a town of considerable size, which lay on the line of road, the volunteers were at drill on the common; and the instant that Solus (that was the name of the horse) heard the drum, he leaped the fence, and was speedily at that post in front of the volunteers, which would have been occupied by the commanding officer of a regiment on parade, or at drill; nor could the rider by any means get him off the ground, until the volunteers retired to the town. As long as they kept the field, the horse took the proper place of a commanding officer, in all their manœuvres; and he marched at the head of the corps into the town, prancing in military style, as cleverly as his stiffened legs would allow him, to the great amusement of the volunteers and spectators, and the no small annoyance of the clerk, who did not feel very highly honoured by Solus making a colonel of him against his will.

The DZIGGITAI (*E. Hemionus*). This is the wild horse of central Asia; and is not found in any part of the country which slopes to either sea, but chiefly in the elevated and sandy plains which lie to the southward of the Altaian mountains, and the north west of Chinese Tartary. The native name, which it is difficult to spell in our alphabet so as to bring out the

correct sound of the first consonant, means "long ear;" and the specific name, first given to it by Pallas, signifies "half-ass," which is not undescriptive of its general appearance. This animal is about the size and figure of a mule, only it is more elegantly made. The head is proportionably larger, and more compressed latterly, than that of the domesticated horse. The forehead is straight and flat; the lips, especially the upper one, are capable of a great deal of motion; the chin and borders of the nostrils are furnished with hairs, about two inches long, forming a sort of mustachios, which are of great service to the animal, in preventing the sand from getting into its mouth and nostrils, as it browses the scattered tufts which spot the barren surface of its pastures. The ears are longer than those of the horse; they are pointed, and the animal carries them very gracefully. The neck is more slender than the neck of the horse, and compressed. It is furnished with a mane of soft brown hair. The body is elongated, compressed latterly, and arched in the spine. It stands comparatively very high on its legs; and the hoofs on the feet are black, and sub-conical, evidently fitted for walking on hard and dry surfaces. The tail bears some resemblance to that of a cow, having short hair for the upper half of its length, and a brush of black hair, nine or ten inches long, at the point. The general colour is greyish fawn; but the summer and winter covering differ considerably, the summer being smooth and flat; and the winter, long, loose, and flocculent, like the winter hair of the camel.

It appears that in former times this animal was found in regions where it is not now to be met with. Aristotle mentions it as being found in Syria, and Ælian describes it as an inhabitant of India; but it does not appear that in modern times it has ever been found to the southward of the mountains: it is highly probable that it is this animal, which has been rendered the wild ass by our translators of the Bible; and besides its great fleetness, there is one peculiarity noticed in the Bible, which is almost decisive on the point, that of "snuffing up the wind," in which the *dziggital* does more frequently, and with greater energy and style, than any other animal whatsoever. It is probably also the swiftest of all animals; for though the horses of the Tartars are fleet and enduring, it is in vain to attempt following this animal, so as to run it down, though mounted on the finest Arabian.

The Tartars do hunt it, however, both for the sake of its flesh, which they prize highly as an article of food; and for its skin, of which they make excellent leather. Their mode of catching it very much resembles the Highland mode of catching wild deer, or the Scandinavian method of hunting bears,—that is, by a "tinchal," or surrounding circle, which is gradually narrowed, until the animals are hemmed in on all sides, without the means of escaping. The only difference is, that the Tartar circle consists of horsemen, while the others, being in countries where horses cannot readily act, are performed on foot. The animals are usually found in troops, consisting of from twenty to thirty, and sometimes as many as a hundred. These troops are headed by a chief, whose duty consists in watching over the interest and safety of the party, and in cases where danger is apprehended, he is ever on the alert to give the signal for retreat. As the chief is ever the foremost to approach the hunter, his temerity often proves fatal to himself; and his fall is invariably followed by a

dispersion of the troop, which affords additional facility for the destruction of the individuals which compose it. The Mongols, the Touguses, and other nations in the vicinity of the Great Desert, esteem the flesh of these animals as delicate food; and, therefore, they hunt them for the purpose of eating their flesh. Though taken when very young, the dziggital has not yet been tamed by these nations, nor does it appear very likely that they will ever be able to do this, for some of the animals have actually killed themselves by the shackles which have bound them, rather than endure the restraint. It is the opinion of Pallas, however, that under proper management, the taming of the dziggital is practicable, and we cannot doubt but that he is correct; for we do not believe that there is any animal on the face of the earth which may not be brought to a certain degree of domestication. It would certainly be a most desirable object to have these animals reduced to a state of subjection; for no animals in the world would make better ponies.

The tract of country which these animals inhabit is one which must, from its locality, have very peculiar characters; but it so happens, that it is the portion of Asia, we may almost say of the whole eastern continent, with which we have the least acquaintance; it extends from 70° to 120° east longitude, and the parallel of 45°, or the latitude answering to the south of France, passes nearly through the middle of it. It is bounded every where by mountains, and no river flows out of it to the south or the west; and those which flow to the north and east, flow but very short distances across it. Towards the west it is divided into three portions, by chains of mountains lying south-west and north-east, the little Alti on the north, the great Alti next southward, and the Musart mountains further to the south, and then the mountains of Thibet form its southern boundary. The three divisions of it are between four hundred and five hundred miles each; and the central division, which occupies the whole breadth toward the east, is more than two thousand five hundred miles in length, and at least eight hundred in its greatest breadth. Thus it is a very large country; and though the rivers all rise in the mountains, and descend towards the intervening spaces, where they are in general lost in the sand, or evaporated by the high temperature of a rainless atmosphere, yet it is understood that those level portions form a table land of great elevation, though how many feet above the level of the sea has not been ascertained.

This is, in its physical circumstances, perhaps the most singular country on the face of the globe; and with the exception of vast numbers of burrowing rodentia, which swarm in the northern parts of it, the dziggital is one of its most peculiar and characteristic inhabitants, and seems to be, more than any other animal with which we are acquainted, an inhabitant of the desert, and fitted for its habitation. It is never found in the forests or on the mountains, whether they are rocky or clad with snow, but keeps to the open and thirsty plains upon which there is no vegetation but tufts of herbaceous plants scattered widely apart from each other. Thus, in order to procure a subsistence, it requires that extreme swiftness of foot to which we have alluded; and as the extremes of summer and winter in such a country must be great, the seasonal changes of its coat fit it admirably for enduring them. The season of heat is about the end

of August; and the foals are dropped in the spring, generally only one at a birth; and they are full grown at the age of three years. In consequence of the extreme shyness and fleetness of the animal, as well as of our ignorance of its country, our knowledge of its habits is but limited. It is ascertained, however, that it can travel a hundred miles or upward without tasting water; and also that it can bear hunger for a long time. It is, however, an animal of wild nature only; though from the circumstances that we have mentioned, it is a very interesting one. Some idea may be formed of the energy of its character from the fact, that in the wild mythologies of the hordes which inhabit the borders of those deserts, it is the animal on which the god of fire is supposed to ride—he scorning all others as too slow for his purposes.

This animal must not be confounded with the wild ass of the same part of the world; for the two do not inhabit the same places, the wild ass being nearer the inhabited countries than this animal, and far less swift in its motion. They are at once distinguished by the superior symmetry of this animal, and by the voice. The wild ass brays, while the dziggital neighs, in tones more loud and clear than those of the horse; and as is the case with horses, the different members of the herd of those animals evince a very great attachment for each other; and as their fleetness protects them against all their human foes, they live in the wide solitude of their mountain-encircled deserts, in a state of perfect peace with all the rest of the living world, the members of which, indeed, are few and far between in the places which they inhabit.

THE QUAGGA (*E. Quaccha*) is an African species, and very abundant in the territory of the Cape, where it is found in large herds, especially in the interior of the country; and it is by no means so shy as the species last described, neither is it so fleet. It is also a much smaller animal, not standing above three feet nine inches at the shoulder. Its tail resembles that of the ass, or rather, perhaps, that of the cow, as in the last mentioned species; but it appears to be as nearly allied to the horse as to the ass, though perfectly distinct from both. Its figure is very light, its head and ears small, and its hoofs cylindrical. Its colours are, the head and neck deep blackish brown, streaked with greyish white, the streaks being lengthways on the forehead and temples, crossways on the cheeks, and forming triangles, or rather cheverons, on the space between the eyes and nose. The ground colour of the body is clear brown on the back, becoming paler on the sides, and passing into pure white in the middle of the under part; while in the middle of the upper, there is a dorsal line of black, extending from the tail to the mane, and the mane is black. There are along each side of the neck ten bands of the same whitish colour as those on the temples. Their cry is different from that of both the horse and ass. Some have compared it to the barking of a dog, and the name *quagga* is also understood to be an imitation of it, though the word *couaay* perhaps comes nearer to it.

The quagga bears some resemblance to the domesticated horse in manners as well as in form. It is a spirited little animal, and repels the attacks of such animals as the hyæna, but it is at the same time easily domesticated, and a willing servant, and not weak, considering its size. There have been instances of carriages drawn by quaggas in the neighbourhood of London; and though there has not, perhaps, been so

much attention paid to them as they deserve, they are frequently employed for doing the work of ponies in the Cape colony.

Where that colony is thickly peopled they are not found ; and they migrate, quitting the confines of the colony for places farther northward, when the dry season begins to burn up the pasture ; and they do not return again until the rainy season has set in, and vegetation again appears upon the *Karoo*s. On their pastures, and during their migrations, they keep by themselves, and do not associate with the zebras, which pasture nearly the same grounds, and migrate in nearly the same manner. Indeed all the swifter herbivorous mammalia partake more or less in this migration ; and as they are exceedingly numerous, they furnish abundant food to the lions, which often follow them down to the fields of the settlers, committing depredations upon the domestic animals, and not unfrequently carrying off some of the people.

THE ONAGGA, or DAUW (*E. Montanus*), is another African species, which has been confounded with the quagga, and still more frequently with the zebra, though it is perfectly distinct from both in its appearance, and also in its localities. The quagga is never found but on the plains, for which the shape of its hoofs particularly adapt it ; while this species is wholly a mountaineer, and seldom descends to the broad pastures. The distinction between it and the zebra will be best given in the words of Mr. Burchall, to whom we are indebted for the first satisfactory account of it as a species. "The hoofs of animals," says he, "destined by nature to inhabit rocky mountains, are, as far as I have observed, of a very different form from those intended for sandy plains ; and this form is in itself sufficient to point out the *dauw* as a separate species. The stripes of the skin will answer the purpose equally well, and show at the same time the great affinity and specific distinction of the *ass*, which may be characterised by a single stripe across the shoulders. The quagga has many similar marks on the head and fore part of the body ; the zebra is covered with stripes over the head and the whole of the body, but the legs are white ; and the wild *paarde* is striped over every part, even down to the feet. The zebra and wild *paarde* may be further distinguished from each other, by the stripes of the former being brown and white, and the brown stripe being double, that is, having a paler stripe within it ; while the latter, which may be named *Equus montanus*, is most regularly and beautifully covered with black and white stripes : add to this, the former is never to be found on the mountains, nor the latter on the plains."

Wilde Parde is the name given to this animal by the Dutch settlers at the Cape ; *Dauw* is the Hot-tentot name ; and *Onagga* is a sort of imitation of the voice of the animal. It is less in size than the *ass* ; but it is more handsomely shaped than even the zebra. Very little is known respecting its manners, for it is rarely seen in consequence of the difficult character of the places which it inhabits. From the heavy rains which fall in Southern Africa, the water-courses are torn deep into the rocks, so as to form complete interruptions to any thing like a passage among the mountains ; and thus it is difficult to obtain those animals alive, and consequently their habits in a state of nature cannot be observed, neither can it be well ascertained to what degree they are susceptible of domestication. As their general form has

still a good deal of resemblance to that of the horse, the probability is that they *might* be domesticated. If this could be done, there is no doubt that from the nature of the ground on which they keep their feet, they would make excellent hill ponies. More must be known of them, however, before we can come to any conclusion respecting their characters.

THE ZEBRA (*E. Zebra*). This species, which is nearly intermediate in character between the horse and the ass, is found in all the warmer parts of Africa, at least from Abyssinia to the southern extremity of the continent ; but now, at least, it is most abundant toward the south. It is probable that, in former times, it was found also to the northward of the desert ; for it was not unknown to the Romans, but, on the other hand, brought to Rome upon many occasions, though perhaps not till the time of the Emperors. Dion Cassius says that, in one day, the Emperor Caracalla killed an elephant, a rhinoceros, a tiger, and a *hippo-tigris*, or horse-tiger, by which it is understood that the zebra was meant. It is also mentioned that upon another occasion there were brought from the islands of the Erythrean Sea, some horses of the sun, which were coloured like tigers ; and there is no doubt that these must also have been zebras. It is also said, that upon certain occasions the kings of ancient Persia used also to sacrifice a horse of the sun, as an expiatory offering of the most important character. This last circumstance does not prove that those horses of the sun were natives of Persia ; but rather the reverse, because of the value of the sacrifice of a single one in the year. Diodorus Siculus says that the zebras were brought from the country of the *Troglodytes*, or men who dwelt in caves, which were near neighbours to the men without heads, and the men with only one broad foot, which they could use as a parasol upon occasions ; and this country of the *Troglodytes* is understood to have been the country on the African side, from the strait of *Bab-el-mandel* to Cape *Guardafui*, to the eastward, off which the island of Socotra, which is probably the one alluded to in the former statement, is situated. Be that as it may, the accounts are sufficient to show that the zebra was known to the Romans, and also to other nations of antiquity ; but that, though they sought after it for its beauty of colour, they were unable to tame it ; and that consequently it must have been the same species as the zebra of the present day, which resists every attempt at domestication.

In a state of nature the zebra is rather larger than the ass ; and resembles that animal more in form than either the quagga or the onagga. There is, however, a good deal of confusion in the names and descriptions ; because all the three were mixed up in the description of the zebra by the older naturalists ; the quagga being regarded as the female zebra, and the onagga, which is less than the zebra but more completely striped, as the young male. All the three animals are, however, perfectly distinct ; and the zebra, notwithstanding the beauty of its markings, has no claim whatever to the known mildness of the quagga, or the presumed mildness of the mountain species. We shall quote a small portion of Buffon's description of this animal, in order to show with what caution the writings of naturalists of that period ought to be received. The passage is short, but so circumstantial that one would think the author must have been acquainted with zebras during the whole of his lifetime ; and yet the accounts of the three-striped

animals of Southern Africa are all blended in it with most perfect confusion. "The zebra," says Buffon, "is perhaps of all quadrupeds the best made, and the most beautifully clad by the hand of nature. To the figure and graces of the horse, it adds the light elegance of the stag, and the black and white bands with which its body is ornamented are arranged with such wonderful symmetry that we might almost be disposed to imagine that rule and compass had been employed in their formation. These alternate bands are narrow, parallel, and exactly separated; they extend not only over the body, but the head, thighs, and legs, and even over the ears and tail. They follow so exactly the contours of the different parts, enlarging more or less according to the development of the muscles, and the roundness of the different forms, that they exhibit the entire figure in the most advantageous point of view. In the female, these bands are alternately black and white; in the male they are black and yellow, but always of a lively and brilliant tint. They also rest upon a ground of short, fine, and copious hairs, whose lustre considerably augments the general beauty of the colours."

These markings are: the ground colour milk or cream white, with a slight tinge of pale buff or rust colour; but this ground is not absolutely constant in the different individuals. The stripes are black, or blackish brown, running crossways on the body and limbs and down the face. The tail is of moderate length; round in its section, rather slender, marked with a few rings of black or brown, and ending in a brush of hairs of the same colour. Their voice is different from that of all the other species of the genus, being a sort of whizzing or booming sound broken into short lengths.

In their native plains, zebras assemble in large herds, and add much to the interest of places whose character is otherwise both tame and dreary. They are still found in several districts within the Cape colony, but they appear to be more numerous farther into the interior.

The Hottentots and Bushmen of Southern Africa hunt the zebra with great assiduity, in order to feed on its flesh, which they esteem a dainty; and the skin, besides its beauty, is firm and compact, and used for many domestic purposes. The zebra, though much hunted, is not a very timid animal; but it is of rather unsteady temper, and very prone to biting and kicking. Hitherto there has not, we believe, been any instance of its complete subjugation to such a degree as that its obedience could be depended on for any length of time; though there have been many instances in which one that had been long accustomed to the society of human beings allowed certain liberties to be taken with it. There was one in the Tower of London which would suffer a boy to be set on its back, without either biting or kicking; and it was sometimes in the habit of going to the Canteen for a draught of ale, a beverage of which all the horse tribe are particularly fond. Of those which have been kept in other collections in Europe, some have been comparatively mild, and others mischievous; but we are not aware of any case in which they have been completely trained, or where full confidence could be placed in them. Their heels are generally pretty ready, and they not unfrequently try to get a kick even at those who are giving them their food. It by no means follows, however, that they are untameable, or that they might not, if treated with sufficient skill,

be brought into complete subjection. Their handsome appearance renders this well worthy of a trial; for as the whole race are capable of enduring great changes of climate, there is no doubt that they could in time be brought to bear our winter without any difficulty.

The female zebra is understood to go twelve months with young; and the young ones have the markings, only the brown is much paler. Zebras produce mules both with the horse and the ass: and those produced with the horse are said to partake of some of the docile qualities of that parent, and submit to be driven in harness. It is also said, that in these crossings the markings of the zebra are much more perfectly retained than in the crossings with the ass; and this is highly probable, because the horse is far more prone to break into different colours than the ass; and it is a general law, that that which is most yielding in its own colour as a species takes most readily the colour of another species in the case of a cross. The cross with the ass has but little of the marking of the zebra, and one is mentioned which was produced between a female zebra and a Spanish ass. It continued to suck for a year; but as it grew it gradually lost the resemblance of the mother, and became vicious and mischievous. Its colour was dark grey, with transverse bands on the legs, the shoulders, and the tail. It did not neigh, and, as M. F. Cuvier expresses it, it "loved to wallow in the mire, and attacked all the world with feet and teeth."

Such is a brief outline of the genus horse, in which we have endeavoured to touch upon as many points as appeared to be at all consistent with our limits.

HORSE-STINGER. A name improperly given by the ignorant to the insects composing the family *Libellulidæ* or dragon flies, a perfectly harmless group of insects.

HORSE-CHESTNUT. See *HIPPOCASTANÆ*.

HORSE-RADISH is the *Cochlearia armoracea* of Linnæus, a well-known culinary plant, and found wild in many places in England. It belongs to *Cruciferae*.

HORSE-RADISH TREE is the *Moringa pterygosperma* of Decandolle, a common East Indian tree belonging to the order *Leguminosæ*. The roots are used as a condiment like those of horse-radish.

HORSE-TAIL is the *Equisetum palustre* of Linnæus, a marsh plant of curious structure belonging to a natural order to which it gives a title, *Equisetaceæ*.

HOSTA (Jacquin). A genus of Mexican evergreen shrubs belonging to Linnæus's second class, and to the natural order *Verbenaceæ*. The species are cultivated in our stoves, and succeed well under the ordinary management.

HOTTŌNIA (Linnæus). A small herbaceous plant indigenous to England, belonging to the fifth class of sexual botany, and to the natural order *Primulaceæ*. It is usually found in wet ditches.

HOUSE-LEEK is the *Sempervivum tectorum* of Linnæus, a common British plant, frequently seen growing on roofs of houses. It belongs to the *Crasulaceæ*.

HOUSTONIA (Linnæus). A genus of North American herbs, belonging to *Rubiaceæ*. The flowers are pretty, and the plants are usually kept in pots or placed in rock-work.

HOVEA (R. Brown). A genus of evergreen ornamental shrubs from New Holland. The flowers are diadelphous and belong to *Leguminosæ*. The *H. celsi* and *H. purpurea* are esteemed greenhouse plants,

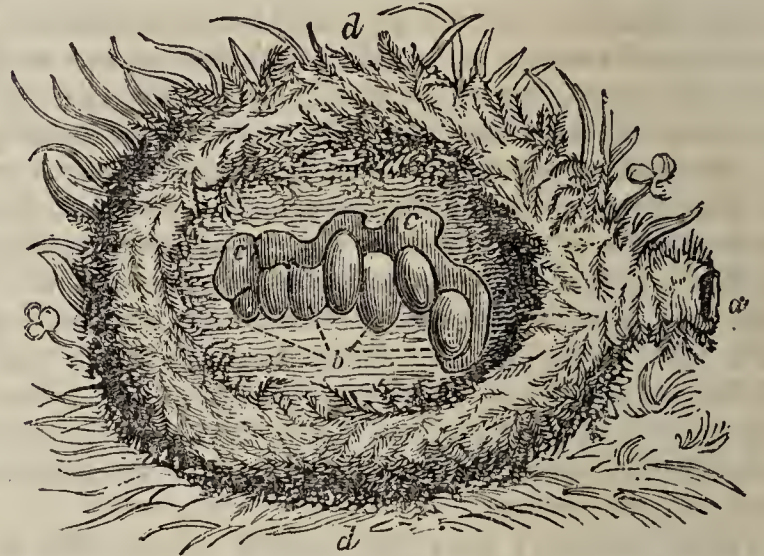
are grown on light loam and moor-earth, and are propagated by cuttings.

HOVENIA (Thunberg). A genus of fruit trees, natives of the eastern parts of Asia, belonging to *Rhamnææ*. Generic character: calyx of five spreading parts; petals alternating with the segments of the calyx and convolute; stamens opposite the petals almost hidden; style simple; stigmas three; peduncle thick and succulent; seed vessel three-berried. The most remarkable part of the structure of the fructification is, the peduncle after the petals are fallen becomes enlarged and succulent, and filled with a sweet red pulp, having somewhat the flavour of a pear, and are esteemed as a fruit in China and Japan.

HOYA (R. Brown). A genus of curious fleshy-leaved climbing plants, natives of India and China, and belonging to the natural order *Asclepiadææ*. These plants are easily propagated by cuttings, and are grown on loamy soil, requiring but little water in winter.

HUMBLE-BEE (*Bombus*). A genus of social hymenopterous insects, belonging to the section *aculeata* and sub-section *mellifera*, distinguished generally by having the upper lip transverse; the proboscis not so long as the body; the second joint of the labial palpi pointed, having the two terminal joints inserted laterally; the posterior tibiæ terminated by two spines; the body thick and very hairy; and, lastly, by the presence of individuals of the neuter sex, with the social peculiarities necessarily resulting from such circumstances, and to which we have already alluded in our article BEE. This is a very well-marked group of insects, as contrasted with some other of the genera of bees; but the investigation of the numerous species of which it is composed is attended with very great difficulty; nor is it possible that many of the doubts, at present existing, can be cleared up until a more minute examination of the nests of the various species has been made, whereby only we shall be enabled to give to each species its own individuals. Huber, Reaumur, and Dahlbom, however, have gone far in enabling us to give a tolerably complete account of their habits. The communities of these insects, which have more the character of a republic than that of the monarchy of the hive bee, are annually dissolved at the approach of winter. At this period the fecundated females hide themselves in the crevices of walls, or trees, or under ground; the males and aged females not having this instinct, perish with cold, so that upon the arrival of the next spring, the former only, which had lain dormant through the rigours of the winter, remain alive; these, being soon actuated by a desire to deposit their eggs, are previously compelled to construct a nest for themselves, the workers being all dead; each bee, therefore, has now separately to seek a fresh abode, to prepare it for the reception of, and to make, a quantity of waxen cells, as well as to get a supply of honey. The situation of the nest depends upon the species; some of them dig to a considerable depth underground (as the *Bombus terrestris*), whilst others select a crevice in a heap of stones (as *Bombus lapidarius*), and others (as the *Bombus muscorum*) place their nest, covered with moss or dried leaves, upon the surface of the ground. In the first of these cases, it is necessary that a narrow passage, a foot or two long, should be made to the chamber in which the nest is made, and for which a mouse's nest, or a mole hole suits admirably. The walls of this retreat, as well as the sides of the pas-

sage, have to be rendered smooth. Those species, whose nests are above ground, select a spot somewhat hollowed out and surrounded by plants, either in the open field, or in hedge-rows, banks, &c.; this spot is then cleared, and a dome of moss raised, the little bundles of which it is formed being successively pushed backwards till they are brought home. The passage leading to this nest is also similarly carpeted.



Nest of humble-bee recently commenced; *a*, covered entrance; *b*, waxen cells in which are placed the eggs; *c*, waxen envelope commenced; *d*, mossy dome commenced.

These are the chief differences which exist amongst the humble bees, which some authors have thence divided into carder bees (*B. muscorum*, &c.), lapidary bees which also use moss (*B. lapidarius*, &c.), and humble bees which do not use moss (*B. terrestris*, &c.) As, however, these bees resemble each other in the remainder of their proceedings, the provisioning and enlarging of the nest, and rearing the young, we have not hesitated to introduce them into a single article. Having thus prepared a nest, and given to its dome a rough inner coating of wax, the female places in the middle of it various irregular masses of brown wax, named by Reaumur, *la pâtée*, and which he compares to truffles. Their hollow centres are destined to hold the eggs and grubs when hatched; and are supplied with pollen paste. Here the larvæ live in societies of five or six individuals, until the period arrives when they are ready to assume the pupa state, at which time they separate, and each spins for itself an oval silken cocoon, attached to each other in a vertical position. Reaumur asserts that these grubs feed upon the wax which forms their lodging; but in the opinion of Huber, the latter merely defends them from outward accidents, the food of the larva consisting in a supply of pollen moistened with honey, which the workers take care to supply from time to time, opening the cells, and again closing them after the young have been fed. It is stated, that when the larva is full grown it reverses its position, and becomes a pupa head downwards; in which position, also, the bee makes its escape out of the cocoon; but Dahlbom states that the insect having remained in the pupa state for five days, and then become a perfect bee, immediately begins to gnaw the inside of its cell, upon hearing which the female, with great instinct, immediately approaches the cell, and gnaws round its outside near to the top, from which labour she does not desist until the cap or upper part of the cell has fallen off, and the bee makes its way out of the hole at the top of the cell. The colours of the hairs of the insect when first disclosed are grey, but they shortly assume their proper colours. When these

cocoons thus become untenanted, they are not allowed to remain useless, but are said to be employed by the bees to hold honey and pollen, the tops being provided with a rim of wax, for which service they are well adapted, their form now being that of an egg with one end broken off. Latreille, however, is inclined to doubt this fact, because these cocoons are of a silken nature, and are asserted by some authors to have the aperture by which the bees have escaped at the bottom end. But we have seen that the latter circumstance is at least refuted by some authors, and the different manner in which these breeding cells are transformed into honey reservoirs has been distinctly noticed; thus some give them an internal coat of wax, which would remove Latreille's other objection, whilst others add at the top of the breeding cell funnel-shaped tubes of wax, whilst others content themselves with merely giving the broken margin a waxen rim. But what appears more strongly to prove that the bees prefer making use of cells thus already at hand, and which require but little pains to render them useful, than to take the trouble of making fresh cells, is the curious fact that they contrive, out of four of such breeding cells, to construct five honey reservoirs in this manner: having built waxen tubes to four adjoining cells, and joined the sides of such tubes to each other, an acute quadrangular space is left in the middle, and this space by having a slight coating of wax given to it is easily transformed into a honey reservoir. Cells, however, thus converted are only found in the months of May and June, in the middle of the lower layer of cells from which the early born neuters are produced; and this is another reason why we are induced to believe this fact of conversion contrary to the opinion of Latreille, since it is evident, from the paucity of inhabitants and the quantity of duty which must at this period devolve upon each, that they would resort to all possible expedients to save labour; and this enables us to account for another circumstance in the history of these insects which has been turned to their disadvantage, but which we cannot help thinking tells the other way. Naturalists have held up the hive bee as exhibiting the perfection of insect instinct, and certainly the inspection of a hive-bee's comb would lead to this conclusion. But this is the work of a perennial association never dissolved, and each constantly employed in perfecting the contents of the hive, whilst the case is quite different with the humble-bee; the interior of its nest is all irregularity, and its young, instead of being separately cradled in a waxen cell, are at first herded together in a general cell. The nest indeed is as ingeniously constructed with its dome of wax and elegant covering of moss as the nest of the bee, although here the community is annually dissolved, and the structure, which we have described, the work of a solitary female, endowed, however, with a far more extensive instinct than the inhabitants of the hive of which the various duties are performed by various sets of individuals selected for such particular purposes.

Previous to the completion of the inner coat of wax, the upper portion of the dome has been observed to be opened, on a fine sun-shiny day, "to the extent of an inch, in order, probably, to forward the hatching of the eggs in the interior, but on the approach of night, this was carefully covered in again. It was remarkable that the opening which we have just mentioned was never used by the bees for either their

entrance or exit from the nest, though they were all at work here, and of course would have found it the readiest and easiest passage. But they invariably made their exit and their entrance through the covert-way or gallery which opens at the bottom of the nest, and in some nests is about a foot long and half an inch wide. This is, no doubt, intended for concealment from field-mice, pole-cats, wasps, and other depredators." —Insect Architecture, page 66.

The parent *Bombus*, having thus founded the nest, formed a certain number of cells, and deposited her eggs therein, and seen the birth of some of her offspring, dies. The eggs first deposited produce only neuters, which assist their mother in her labours, but the female afterwards deposits male and female eggs. The females produced from these eggs attain a size larger than the workers, although smaller than the parent. Like the neuters they join in the common works of the nest; and like their parent become fruitful, by impregnation by the males, *born at the same time as themselves, which are also smaller than those males produced at the end of the summer. It may be asked, whether the development of these females is attributable to peculiar food, as is the case with the royal jelly of the queen bees; but this question, although analogy induces us to answer it in the affirmative, owing to the difficulties of observation of the internal economy of the nests of the *Bombus* is at present undecided, notwithstanding the investigations of various observers; as the humble-bees, unlike the hive-bees, refuse to remain in experimenting boxes or glass cages prepared for their reception, but return to their own quarters, so that we are obliged in making a consecutive series of observations to have recourse to the opening, from time to time, of natural nests, a proceeding of danger, owing to the infuriation and powerful stings of the insects.

The community now increases in proportion to the number of young, middle-sized females; the number of males rapidly augmenting, leading to the supposition that the former only gave birth to these individuals; but at the end of August, several females, varying in number from three to eight, according to St. Fargeau, are produced, which are destined to survive the winter after impregnation, and become the respective foundresses of fresh communities. The males which are their partners are also of larger size than their elder brethren, being born at the same time as the larger females.

The tongue of the humble-bee is organised for the gathering of honey, in the same way as that of the hive-bee, with this difference, that in the former it is furnished, near the tip, with a great number of long hairs, forming a brush, enabling the insect to collect a much greater quantity of honey at a time. On arriving at a flower, the bee unfolds its proboscis, in the manner which we have described in our article BEE; and removes with the elongated lobes of its maxillæ, and its labial palpi, the petals and stamens, so as to enable it to insert its tongue into the nectary without obstruction; the nectar, thus gathered, ascends by the œsophagus into the stomach, and is then purified.

It some times, however, happens, that the bee selects a flower having a longer tube than its own

* Some authors assert that the young small females are born long before the smaller males, and yet deposit eggs which produce only males, from which it would appear, as Huber asserts, that, as in the Aphides, a single impregnation is sufficient for more than a single generation.

proboscis, so that it is not enabled to reach the nectary ; but this difficulty does not intimidate the *Bombus*, for, from a series of recent observations, made both in this country and in France, it is certain, that the humble-bee has the instinct to alight upon the base of the flower, gnaw a hole through it with its jaws, and thus extract the honey. When it has taken its fill of this delightful beverage, it returns home, where it has duties to perform ; for instead of using the honey thus gathered for its own nourishment, it carefully explores the cells to discover the fitness of them, and then inserting its head and part of its thorax into one of them, it unfolds its tongue, compresses the wings of its body, and disgorges from its mouth the honey, clear and bright. The hairiness of the body of the bee renders the collection of pollen an easy matter, and it is no uncommon thing to see a humble-bee come out of a scarlet poppy, a perfect sweep, entirely covered with the black farina ; or out of a holly-hock, with his jacket as white as a miller's : this pollen is afterwards gathered together in lumps and deposited in the pollen plates, upon the posterior tibiae, by the assistance of the pollen brushes, the structure of which is similar to those of the hive-bee, only we here observe one of those remarkable and interesting facts, which so amply prove the truth of the saying, "natura maximè in minimis observanda." The female hive-bee takes no share in the labours of the hive ; they do not possess pollen plates, which would, of course, be useless to them ; but the female *Bombi*, which join with the neuters in all the labours of the nest, are like them furnished with pollen plates. And it is owing to this necessity existing for the social good of the community, that the female *Bombi* exhibit none of that savage ferocity towards each other, which we have seen to exist in the queen of the hive against even the nymphs of a supposed rival.

When fully established, a nest generally contains fifty or sixty individuals ; but Reaumur counted one hundred and fifty empty cells in one nest ; and occasionally, but very rarely, the number of inhabitants are stated to amount to two or even three hundred ; and now it is that a division of labour takes place. Some take the duty of increasing the size of the nest, and, for this purpose, unite in bringing moss to the nest, just as we see labourers digging stone from quarries, and wheeling it one by one in barrows for short distances, and then consigning it to the next of their companions. In like manner, a file of bees, sometimes amounting to half-a-dozen, is formed between the nest and the heap of moss, the heads of the bees being turned from the nest, and towards the moss. The bee nearest to the moss seizes and detaches a piece with its jaws, and rolls it into a little bundle with its fore-legs, which it pushes under its belly and passes to the next bee, and so on until it reaches the nest. Others now construct pillars of wax, supporting the columns ; others prepare the food and feed the grubs ; others see to the neatness of the nest, removing all useless things from its interior ; and others go abroad to collect honey and pollen, with which they return loaded, and deposit it in the cells. Some, however, probably males, appear to be less solicitous in working, and more disposed to enjoy themselves with the good things of this life. To use the words of Rusticius, "the humble-bees on a sun-flower are very odd mannered. They get as drunk as Bacchus or Silenus ; then they get as sleepy as Morpheus, and cross as Cerberus ; if you touch

one, he leans on one side, cocking up the opposite legs into the air, and plays divers other antics, till, with his various trials to show that he is sober and able to fight and defend himself, he sidles, staggers, rolls, and falls to the ground, and there lays on his back till he has slept himself sober."



Bombus lapidarius ; *a*, mandible of the male ; *b*, mandible of the female.

It only remains to notice the distinctions by which the sexes of these insects may be known, by persons desirous of observing their economy. The males are of the middle size, but vary in this respect at different periods of the year, as above stated ; their jaws are narrow, and terminated by two teeth, and on the outside they are clothed with long hairs ; moreover, their colours are occasionally different from the individuals of the other sex. The females are the largest inhabitants of the nests ; the foundress bee being also larger than any other female subsequently produced ; the jaws in this sex are very broad, and spoon-shaped. The neuters, of which, according to Reaumur, there are two sizes, are either as large as the males, or much smaller ; these have the jaws similarly constructed to those of the females, so that it is difficult to distinguish them, except by their size, and it appears to us thence probable, that the description of the larger neuters given by Reaumur is applicable rather to the early produced and smaller females, and which is confirmed by the statement of Huber, that many of the spring *workers* couple with the early summer males, a fact which the organization of the former would necessarily prevent, if, as we must infer, the analogy between the neuter hive, and humble, bee exist in all its circumstances.

It is a curious circumstance, that a group of bees, having all the appearance, and indeed general structural characters of the humble-bees, are destitute, as Mr. Kirby first observed, of any apparatus for carrying masses of wrought pollen upon their hind-legs, "the females and neuters of these apes exhibiting those characters which are peculiar to the males of the rest of the family. I suspect that they nidificate under ground." Kirby Mon. Ap. Augh. i. 210. These bees have subsequently been formed into a distinct genus, under the name of *Psithyrus*, St. Farg., and it is now supposed by hymenopterists, that they are parasitic in their habits, in which respect the possession of *neuters* (which have never yet been described in any of the species) would be contrary to nature, and it will be observed that their nidification under ground rests only upon the suspicion of Mr. Kirby, expressed more than thirty years ago, but which has never yet been confirmed.

HUMBLE PLANT is the *Mimosa pudica* of Linnæus. The movements of the leaves and leaflets of these vegetables, upon the slightest touch, have always excited attention, but the immediate cause has hitherto baffled all philosophers to explain satisfac-

torily. The leaflets of the *Mimosa sensitiva* collapse when touched, but the entire leaves of the *pudica* suddenly drop.

HUMEA (Smith). A very elegant plant introduced into Europe from New South Wales. It is a biennial, and belongs to the natural order *Compositæ*. It is not the flowers, but the elegantly pendent position of its attenuated branches, which makes the plant so much admired.

HUMMING-BIRD (*Trochilus*). A genus, or according to some naturalists, a family of tenuirostral, or slender-billed birds, having the feet anisodactylic, or the two outer toes united at their base, and articulated so as to form in some respects a kind of secondary or supplemental foot, which holds on laterally against the other two toes; while these hold on against each other. Thus the foot takes hold two ways; and the owner of it can run in almost any direction upon the bolls and branches of trees. This is the foot of the creepers which are so well known for the remarkable manner in which they run up and down and round and round the trees in our own forests. But the humming-birds, though they all have this description of foot, have it in less perfection than the creepers, because these feed mostly when using their feet, and the humming-birds are in a great measure wing birds.

They are a most singular genus or group, resembling slightly the nectar suckers of the eastern continent, but still vastly different from them in almost every respect; and different indeed from all known birds. They are the smallest of the feathered tribe, some being not much more than half-an-inch in length; they are the most beautiful in the texture and colours of their plumage; for no matter and no other substance can come up to the richness of their tints, or the glowing brilliancy of their metallic reflections. They are the most active of all known birds, exceeding in this respect even the swifts, they are still more powerfully winged, in proportion to their size, than these are; and there are no birds which have the sternum and the bones which give firmness to the shoulder more finely developed. In fact, the whole of their energy is concentrated upon this part of their organization, and their different styles of flight are all equally vigorous. Suspended in the air, and hovering over a flower, their wings move with so much rapidity that they are not seen, except as gleams of light of different colours, but all radiant, as the beams of the sun take them at those angles at which they give out their different lustres; and while the rapid motion of the wings thus renders them invisible, except as gleams of light playing around the little body of the bird, they make a sound similar to that of the humming produced by the wings of bees and other insects; and it is on account of this, that they get their English name of humming-birds. They can hover about in this way for a considerable time; and this rapid motion of the wings, when hovering, appears to give them an impetus for flight, in like manner as a similar, though slower motion, gives an impetus to eagles and other birds of prey, which stoop with great rapidity through the air. In consequence of the impetus thus given, the humming-birds can in an instant dart from one place to another, upwards, downwards, or laterally, without any apparent effort. When they take longer flights, they do not fly on a level with steady wing, but describe a series of flat arches, each arch appearing as if it were a separate leap in the air.

They are exclusively birds of the American continent, and in the rich and warm districts within the tropics, they swarm as numerous as flies do in summer in the forests of Lapland or Canada. The known species amount to several hundreds; and as their native localities are not easily explored, the unknown species may be very numerous. Individually, they absolutely swarm and people the whole atmosphere with the most brilliant, though minute glories of the living world, which are at the same time in a state of wonderful activity; they are not confined to America, within the tropics, nor to the low and warm parts of the tropical countries; though every where they are more numerous, and in greater variety, in proportion as the place is more warm and fertile. Some, however, are found high upon the table lands, and slopes of the mountains, where the climate is not only temperate, but absolutely cold; others range as far southward as the strait of Magellan, and probably, also, into Terra-del-Fuego, while others, again are found to the north of Canada, as high as the fifty-seventh parallel of north latitude; while on the west side of North America they reach to latitudes still higher. Nor must it be supposed, that even in this cold latitude they are at all out of their place or their element; for when Captain King was surveying the coast of the extreme south of America, he found large flocks of humming-birds flying about, apparently at their ease, in the middle of a snow storm.

The texture of their plumage is indeed as worthy of attention as the tints of colour, and the brilliant metallic reflections; for though they are very little birds in all the species, and not larger than humble-bees in the most minute one, their plumage is exceedingly compact, and probably forms a better defence against alternations of heat and cold, and of drought and moisture, than that of any other birds whatever. The individual feathers are beautifully formed; and more compactly laid than those of any others, if we except the under parts especially, of those birds which are almost constantly in the water without ever getting wetted. But as it would greatly exceed our limits to describe minutely, or even to enumerate, half or even a tenth of the species, we must observe some method in giving brief, general notices of those parts of the structure which come most into action, and may be considered as most characteristic of the whole genus.

The wings claim our first attention, as they are most continually and most vigorously in use. Of the birds in our own country they most nearly resemble the wings of the swifts, but they are more curved than these, and the birds can perform more evolutions on the wing. The closed wings generally extend beyond the point of the tail, unless where that organ has produced feathers, which it has in some of the species. The first quill is always the longest in the wing; and the other primary quills shorten gradually to the last one. The secondary quills are generally speaking very short; and the wings are not so much loaded with coverts as they are in most birds. The strength and stiffness of the wing are produced by the structure of the quills themselves. The shafts of these are always very strong and elastic; and in some of the species the basal part of the shaft is so much enlarged, that its diameter nearly equals the breadth of the inner web. There is a sort of curvature in the shaft, too, which, in the case of a violent strain against the air, throws each quill partly under the one

following it, so that all the rest of the quills act, in some sort, as coverts to the first ones. The webs of the quills are very closely set, and so completely hooked together, that while the bends of the shafts make openings, through which the air is admitted when the wing is rising, the descending wing strikes the air as if it were a solid. It is this peculiarity of the wings which enables the birds to work them with so much rapidity, when hovering, and which makes them proceed in those arches to which we formerly alluded, when they are upon long flight. The stroke which is given at the commencement of each arch is too vigorous for merely carrying the bird onward in level flight, and thus there is an ascending motion at the first, something like that of a bullet fired at a small elevation, and no new effort is required until the end of the arch is arrived at, when a similar stroke carries the bird along another.

The tail, in birds of this genus, is generally powerful; and it has all the varieties of termination which can well be imagined. It is pointed, rounded, squared, forked, very broad, and much produced in some of the species, and consists of very few feathers, not more than six, in some of the others. In every species, however, the feathers are of the same firm character as those of the wings, and the tail itself is capable of a good deal of motion. It will be borne in mind that the tail of a bird, though often described as a rudder by which the bird is enabled to wheel and turn in the air, answers a very different purpose, namely, that of ascent and descent; and we shall afterwards see that humming-birds require to use a great deal of this kind of motion.

The bill is, in all the genera, long and slender; but it has always a good deal of the insectivorous character, though not of the character of those bills which are used for catching prey while the bird flies open-mouthed, as is done by the swallow tribe, and the goat-suckers, or nocturnal swallows. In some of the species the portion of the bill toward the point is armed in both mandibles with small teeth sloping backwards; but these do not extend to the extremity of the bill, which is always very sharp pointed, and sometimes curved downwards at the tip of the upper mandible, and slightly upwards at that of the lower one. In almost all the species the upper mandible is sufficiently broad for overlapping, and partially sheathing the under one. The general form of the bill, though always slender, and nearly of an equal thickness throughout, with the exception of the tip, which is usually very sharp and keen, varies considerably. Systematic naturalists have sometimes divided the birds into two sections, those which have the bill straight, and those which have it crooked; but it does not appear that very much useful information can be derived from this division; because we are not acquainted with any peculiarity in the habits of the bird which depends on the straightness or curvature of the bill. Besides, some of them have the bill curved downwards, as most crooked bills are; others have it curved upwards at the point; and others again have it curved a little downwards in the basal part, and then upwards again at the tip. Nor is even this all; for the teeth in the mandibles are found in some of the straight-billed species, and also in some of those with crooked bills; which last circumstance would lead us to believe that both forms are made use of for catching exactly the same kind of food, though probably not for getting at it in the

same kind of places. It really does seem, therefore, that the most rational way of dealing with this different shape of the bill, at least until we shall be better acquainted with the habits of the birds, is to regard it simply as one of the specific characters. It is much the same with those other foundations upon which the genus has been broken down into more minute divisions;—a mode of proceeding which certainly renders the history of the genus a little more intricate, and therefore more perplexing to learners and common readers; but other than this left-handed sort of merit, it appears to possess none. A difference in the form of an organ is a useful distinction, in all cases where we can take the difference of function and purpose in the organ along with us; and there may be cases in which a difference of structure may be an excellent guide to the difference of purpose; but this does not hold in such cases as the one under consideration. If we leave out the distinction of being toothed or not toothed in the edges, the bills of all humming-birds resemble each other in their texture, and in the nature of their cutting edges; and therefore we may naturally enough conclude that the leading work to be done is nearly the same in the case of them all; and that the differences in shape relate to certain variations in the places whence the birds obtain their food; and these can be found only by observation, which has not yet been made; and therefore there is no room for speculation upon the subject.

The tongue of the humming-birds is rather a singular instrument; and it resembles the tongues of woodpeckers more than those of any other birds. It is protrusile and retractile, or can be darted beyond the extremities of the mandibles and drawn back again. This is effected by a muscular apparatus not very different from that which gives the same kind of action to the tongue of the woodpeckers. It should seem also that, in some cases at least, the tongue is furnished with barbs very similar to those in the woodpeckers. This tongue is described as consisting, in many of the species at least, of two muscular tubes, which are united together for the greater part of their length, but open towards the point of the tongue, and form something resembling a pair of small forceps. The muscular fibres of those hard tubes are placed in a sort of spiral manner, so that when they act, they lessen the diameter of the tube, but increase its length, and this with a degree of rapidity proportional to their number. So that this tongue has not exactly the same texture as the tongue of the woodpecker, nor does it appear that they contain bone and cartilage as that tongue does. It is probable, also (for the point has not been investigated with much care), that the barbels upon the tongue are not composed of so hard a matter.

In no case, however, does it appear that their tongue is, or indeed can be, an instrument of suction; and indeed we know of no animal in which the tongue alone can perform this office; and of no sucker in any animal which is composed of a single piece. Every sucker must act something upon the same principle as a common sucking pump, and, like that, it must have one part in which the vacuum is formed, and another by which it is to be formed. Thus the humming-bird could not suck with the tongue unless the mandibles answered the first of these purposes; and they are not adapted for any such use, but are simply a prehensile instrument, by means of which the food is seized in some in-

stances, while the protrusile tongue, no doubt, seizes it in others ; but whether by means of any viscid secretion, as in the tongue of the woodpecker among birds, and in the tongues of many of the insect-eating mammalia and reptiles, has not been ascertained ; but it is probable that in those cases where the tongue is forked or formed into a kind of forceps, there may be a prehensile instrument, which assists in catching the food beyond the reach of the mandibles.

Whatever may be the fact with regard to those minor points, and whatever may be the curvature and structure of the vomer, or cutting edges, there is not the least doubt that the bill of the humming-birds is decidedly an insectivorous bill ; and that it no more sucks any liquid substance, than the bill of the godwit sucks the ooze and mud which it simply searches for any little animals that may be contained in it. Thus when we come to examine the bills of those very beautiful and highly interesting little birds, the first thing that we are compelled to do is to demolish the whole of that fine structure of poetic fancy which goes about to feed them on the nectar or sweet matter in the bottoms of the flower cups or tubes of those plants among which the birds sport about with so much liveliness and brilliance ; and into which they are ever and anon plunging their bills, and their heads and necks up to the very wings. They do not feed upon this nectar, unless, perhaps, they take up a portion of it along with that which constitutes their principal food. But though the birds do not feed directly on any part or product of the flowers, they do so indirectly in many instances ; for the land of humming-birds is in an especial manner also the land of insects ; and though some of the winged insects are larger than the birds themselves, there are countless thousands of others which are exceedingly minute. Of these a vast number of species are found sporting in the air ; while others are on the leaves, and especially in the flowers, with which the forests of America so much abound. The central forests of that country are festooned with an endless number of climbing plants, usually having the flowers, more or less, bell or trumpet-shaped, many of them of large dimensions and of the most splendid colours ; and these flower-cups are turned in every imaginable direction, upwards, downwards, or obliquely ; and not a few of them have a curvature in the narrow part of the tube. Thus bills which are long and slender, and also which have various kinds of curvature, are required for getting at whatever substances fit for birds' food may happen to be in those tubes ; but from the sharp tips of the bill, and the other circumstances connected with these organs which we have mentioned, this food must be something more solid than any sweet liquid that may be contained in such tubes ; and we believe that many of them are not very remarkable for their sweetness.

An examination of the deep cups of flowers in this country will help us to what really is to be found in these cups ; and when we consider the difference between the one country and the other, and that the air of those places of America literally teems with life down to a minuteness, to which the eye is not able to follow it, we can easily see what it is that the birds seek in those gay blossoms ; for it is, and must be, the small insects which take up their abode there.

Humming-birds are, as we have said, exceedingly numerous ; and it is a general law in nature, that every production which is native in any locality, is of

value in the economy of the whole in proportion to its abundance. We find the trees and the ground between very amply furnished with birds ; and also with mammalia, adapted for keeping down the vast production of larger insects which is found there ; and it is natural to suppose that there should be birds fitted for performing the same operation on the flowers which festoon and adorn those mighty forests ; nor could we very readily imagine a race of creatures better fitted for the performance of this duty than the humming-birds are ; they are light ; they are very powerful in the wing ; their plumage can hardly be ruffled ; and their powers of action are very great. On these accounts they do not prey on any part of the splendid flowers which adorn their haunts, but are on the other hand the most efficient conservators of them that can well be imagined ; and as the flowers are in very great variety, as well as in countless numbers, just so are the birds, and their sizes, and the different shapes of their bills ; there is no flower of which they have not complete command, at the same time that their powerful wings bear them from place to place without any apparent fatigue. The *Bignoniaceæ*, or trumpet-flower family, are among the plants of which those birds appear to have especial care, and if the reader will turn to the article BIGNONIACEÆ, and the plate with the same title, he will form at least some idea of the form of the flowers of which the humming-birds appear to take especial care. Some of these, which are climbers, are plants of great beauty, with very handsome flowers ; and they are capable of making their way to the summits of lofty rocks, and the tops of tall trees ; and when the side of an opening in a forest, or the face of a rock, is festooned over with them, and the humming-birds are then in all their activity, multitude, and variety, it is not easy to imagine a finer sight. Some of these plants will grow as far to the northward as the middle States of America ; and there are some, also, which can be trained on a wall in the open air in this country ; but still their head quarters are in the forests of central America, both on the main land and in the islands. In those places, the sun is never far from being directly over head at mid-day, and sometimes it is exactly so ; so that if we suppose the face of the forest or precipice to be turned either to the north or to the south, it will have the benefit of the sun from the time of its rising in the morning to that of its setting at night, only the projections of the different festoons will produce a continual variation of light and shade upon it. In this perpetually varying light upon the splendid and beautiful vegetation, the humming-bird can sport on the wing, and pursue the labour for which they are appointed during the live-long day ; and their appearance in numbers at such a place makes it appear as if gems of greater brilliancy than those of all the kings of the earth were floating about in wanton mazes through the air.

We need hardly advert a second time to the feet of these birds, because we have already hinted at their general structure. They are, like the feet of the swifts, small and weak, as compared with the organs of flight ; but this is true to that system of wise economy, which nature shows throughout all her works, for the feet are seldom used except for the purpose of repose. In this respect there is a considerable difference between them and the feet of the swifts ; and there is a corresponding difference between the kind of surface and substance to which

they are applied. Neither of the birds alight much, if at all, upon the ground; but the swift's foot is adapted for clinging to inequalities in the surfaces of stones and walls, and not for perching upon trees, which the swift never does. The foot of the humming-bird is on the other hand decidedly a perching foot, and they always alight and repose upon trees, bushes, or vegetables of some description or other; and it is said that some of them repose suspended by the claws, with the head undermost, which is the position of sleep among some of the climbing birds, and also of the bats and sloths among mammalia.

Small as these birds are, they are exceedingly bold and pugnacious, attacking not only birds many times their own size, but offering battle to man himself, when he ventures to invade their nesting places. If the nest is approached while the female is sitting, she will fly out, and dart across the intruder with great rapidity, and utter the same sort of sound as a bee does when it menaces an attack in passing. If no direct injury is offered to the nest, the female returns to it in a very short time, and does not again quit it until a new movement is made by the observer. They are, indeed, very little afraid either of birds or of the near presence of man, under any circumstances; and they have no great occasion to fear, because when they are strongly excited, their motion on the wing is so rapid, that the small ones especially can hardly be seen. They may be heard, however, for they utter a sort of scream, not very unlike the screech of the swifts, but considerably more shrill and piercing. From the small prey upon which they feed, their sight must be very keen; and as the sight of long billed birds is never so microscopic as that of short billed ones, they probably see at greater distances than at first thought we would be apt to suppose. They are said to aim at the eyes of those birds which they attack; and in this way their attacks must be much more formidable than their size would lead us to believe, because the point of their weapon is exceedingly keen, and they drive onward with so much velocity, that one stroke of it, taking full effect, would be sufficient to quench the sight of an eagle. Their pugnacity is not by any means confined to those birds and other animals from which they apprehend annoyance; for the males, at least those of the same species, fight desperately whenever they meet. On these occasions they appear to be in a state of the greatest excitement, with every muscle of their bodies in the most intense action; and though their combats are carried on in the air only, they seldom give over till one falls to the ground exhausted, wounded, or dead.

The nests of birds which are so numerous, and differ so much from each other, may be supposed to vary considerably in their sizes in proportion to that of the bird; and rather more than half an inch in diameter may be taken as about the smallest. It is always neatly constructed, but the materials vary in different localities, even with the same species. The eggs are of course small, but not so small in proportion to the size of the bird as the eggs of many other genera; the hatches are understood not to be numerous, two and sometimes only one being the number of eggs usually found in the nests; but they breed with a rapidity unknown in the case of almost any other birds, the time of sitting being about ten days, and the young being able to leave the nest in a week after they break the shell. It is not

known, however, whether all the species come forward in the same short time, for the nests of comparatively few have been carefully examined. All that have been examined, have been found placed on trees, bushes, or vegetables of some sort or another, at a considerable elevation above the ground. One instance is mentioned of a humming-bird being taken on her nest in Jamaica, and brought on board ship. She was tame, allowing herself to be fed with honey, and survived until she hatched her two young ones, but died soon after, probably for want of the proper kind of food. The young survived their mother, and they were fed on the same substance as their mother had been, which was then understood to be their proper, and indeed their only food; and perhaps this also may have been the cause why they did not live long after their arrival in England. In those countries, however, in which they are abundant, all attempts at keeping in a domestic state, for any length of time, have completely failed; and it is natural to suppose that such should be the case with birds which, in a state of nature, are inhabitants of the free air; and, at the same time, so very excitable as these little creatures unquestionably are. That they, or at least some of the species of them, can brave the severity of the weather in both extremities of America, we have direct proof; and as some also have been met with very near the line of snow in central America, perfectly at home, and not appearing to feel any inconvenience, we may naturally suppose that they also can bear a climate which is cold all the year round, at least during the night, while the heat of the sun beats strongly during the day, which is perhaps the severest of all climates.

Central America is, however, their proper place; and it seems to be something connected with the character of the vegetation which makes it so. We have evidence of this when we contrast North America with the southern part of South America; for there has been only one or two species of humming-bird observed to the northward of the Gulf of Mexico, or 30° north latitude, while there are a good many not only under the same parallel in South America, but 20° farther to the southward. Now the character of North American vegetation, and also that of the seasons, ceases to be tropical at no great distance northward of the Gulf of Mexico; while in South America the tropical character continues almost, if not altogether, to the very southern extremity. Still, however, we are not in possession of sufficient data for enabling us to determine in a satisfactory manner why this very singular genus of birds is found in the American continent only, and in no other quarter of the world; for though, as we have said, there is some analogy between them and the nectar suckers of the eastern continent, that analogy is very slight, and does not establish a single important character as common to the two races. There is no such energy of character about that bird, or almost indeed about any bird, which is so great in proportion to its size, as that of the humming-birds; and until we go to the insect-tribes, which have internal muscles acting to the greatest possible advantage, to an advantage indeed which cannot be obtained in the muscular structure of any animal possessing an internal skeleton, we have no instance of so great strength accompanying such diminutive size as we find in the humming-birds.

These curious little birds are not more remarkable for the extreme brilliancy of the plumage, than they

are for the singular production of supplemental feathers, not absolutely requisite either for clothing or for flight, which grow from different parts of their bodies, but chiefly from some part or parts of the head or neck. Those feathers growing from the sides of the head, lengthened and stiff, are sometimes so long as to have the appearance of an additional pair of wings, but they are, of course, without any muscles, by which they can be moved to any extent; and thus they can answer no purpose, save that of a parachute in breaking a fall, which, in birds of so little weight, and so powerfully winged, is not very necessary. These feathers are, we believe, found chiefly, if not exclusively, on the males; and the probability is, that in many cases, at least, they are nuptial ornaments, for we find corresponding feathers, though seldom so much developed as some of these appear, upon the males of many other birds about the commencement of the pairing season, which drop off again after that season is over. But as the humming-birds, in tropical countries at least, breed more frequently than almost any other birds, therefore with them the season of love occupies a great part of the year, and they in consequence wear their livery in gorgets, crests, ruffs, or ear-tufts, that is, produced feathers issuing from the ear-coverts; and those feathers, which are generally of some very brilliant colour, are peculiar in their texture and shape, each of them standing out like a thin but compact scale, which is well defined in its margins, and not easily ruffled.

As we can afford only a very brief synopsis, interspersed with one or two descriptions of such species as have been observed and described with the greatest care, we shall follow the sub-division into five sub-genera, or sub-families, merely for the purpose of breaking the enumeration into shorter portions; for the distinctions of those sub-divisions are so perfectly artificial, and unconnected with any well established difference of habit in the birds, that they are of no use in promoting the rational knowledge of them.

SUB-DIVISION I.—*Trochilus*. These have the bill very straight, with only the tips of the mandibles slightly bent; the tail of moderate length, and either square or rounded at the extremity. This sub-division is mostly confined to the tropical parts of America, but they occur on the islands to the eastward, and also to the westward of the main land; and one at least has been met with on the Island of Juan Fernandez, which is nearly five hundred miles distant from the shore, and another species has been observed as far to the northward as California.

SUPERB HUMMING-BIRD (*T. superb*). This species inhabits the island of Trinidad, and in all probability the adjacent parts of the country. It is bright blue on the top of the head, brilliant purple red on the throat, bordered with a white margin, from which the colour gradually passes into pale grey on all the under part of the body; while the upper parts are golden green, with rich metallic reflections. The tail is rounded, and has the tip of the exterior feather on each side white. It is seen in the woods, but not very common, and nothing is known of its manners.

AZURE-CROWNED HUMMING-BIRD (*T. quadricolor*). This is a very beautiful species, and found chiefly in Brazil, which may be considered as the head quarters of the humming-birds. The total length is about three inches and three-quarters; the bill is very

straight, rather enlarged at the base, and of a bright yellow colour for the greater part of its length, but black at the tip; the upper part of the head is covered with a cap of very brilliant blue, extending from the bill to the neck, and passing in a straight line immediately under the eyes; the upper part of the body is of a brilliant golden green, and the under part, including the under coverts of the tail, pure white; the wings are purplish brown, and very long and falchion shaped; the tail feathers are greenish on their upper surface, and purplish brown on their under, and they are very compact and strong; the tarsi are very short, but the toes are furnished with claws of considerable length. The young birds have the colours much less pure than the adults. It does not appear that the male of this species has produced feathers upon any part during any season.

WHITE-STRIPED HUMMING-BIRD (*T. mesoleucos*). This is also a Brazilian species, though it may be found in other parts of South America. The marking from which it gets its name consists of a white stripe extending from the throat, along the middle of the under part; another, which is slightly crescent-shaped, immediately under the eye; and a third, much less defined, on the turn of the wing. It is rather a large and stoutly made species, being between four and five inches in length, of which the bill, which is very straight, occupies between a third and a fourth; the feathers on the head are scale shaped, and of a greenish colour; the throat is purplish red, extending in a point on each side toward the scapulars; the upper part and the sides are subdued golden green, rather more intense on the middle of the back; the quills are purplish brown, with a slight greenish tinge; and the tail feathers, which are large, and form a slight fork at the extremity, are brownish green, with a round white spot near the extremity of each feather. The female resembles the male, except in having the throat and sides of the neck greyish white.

DUKE OF RIVOLI'S HUMMING-BIRD (*T. Rivoli*). is a Mexican species, rather smaller than the last mentioned, and having the bill nearly of the same form, but differing greatly in the colours. The top of the head is intense blue; the gorget on the throat emerald green; the general plumage deep golden green, remarkable for its varied tints in different lights; the gorget is separated from the cap on the head by a line of the general colour which passes over the eye, but terminates before it reaches the gape; the wings are very long and falchion shaped; and the tail is very broad and straight at the termination.

CORA HUMMING-BIRD (*T. Cora*). A figure of this species is given in No. 3 of the plate HUMMING-BIRDS, from which it will be seen that it is remarkable for the length of the two middle tail feathers, which are longer than the body, being three inches, while that exclusive of the bill is only two; and the bill, which is very slender, is less than half an inch in length. The upper parts are green, the under parts whitish, the gorget brilliant purple red, and the whole plumage remarkable for its lustre. This is a Peruvian species, having been observed on the west side of the Andes, between the city of Lima and the shore of the Pacific.

DOUBLE-CRESTED HUMMING-BIRD (*T. cornutus*). This is, perhaps, the most brilliant species of the whole race, gay as many of the others are. It is a Brazilian species, found on the elevated plains to the northward of the mountains westward of Rio, which are so

rich in gold and precious stones. Its bill is straight; the length of the bill and body about two inches, and that of the tail, which is very pointed, as much more. The centre of the forehead is covered with scaly feathers, with very rich metallic reflections of blue and green; and from each side of the head in an oblique line upwards from the eye, there arise six feathers, which incline forward, and form a very peculiar tuft upon each side of the head. The brilliance of those feathers is beyond all possibility of description; for, according to the angle at which the light is reflected from them, they show the colour of every gem and of every metal when highly polished; and the transition from the one to the other of these is so rapid, that it is impossible to say which is the master colour. The gorget is a very rich purple, extending backwards nearly to the middle of the neck, and forming a point in front which is pendent over the breast. The breast, the fore part of the belly, the lower sides of the neck, and the shoulders, are pure white; the lower part of the belly and the upper part from the shoulders are delicate bronze green; the wings, which are very long, are bronze brown, as are also the two central feathers of the tail, but the remaining feathers of the tail are white. The female wants the produced feathers, but has the green on the body fully as brilliant as the male, and the top of the head a most intense blue, behind which there is a patch of green on the nape, separated from the green on the back by pure white. Both birds are very lightly and elegantly formed, and, taking them altogether, it is impossible to imagine creatures possessed of more exquisite and more varying beauties.

VIOLET-EARED HUMMING-BIRD (*T. auritus*). — Bright green in the upper part, and pure white in the under, with the exception of the vent feathers, which are greenish. A tuft of produced violet feathers, projecting from the ear covert; a black line from the gape across the eye, the tail wedge-shaped, with the extreme feathers white, and the four centre ones very dark green. The female wants the produced feathers, and has the under part greyish. This species is found generally in the northern parts of South America.

VIOLET-TUFTED HUMMING-BIRD (*T. petasophorus*). This is a Brazilian species, with the general tint of the plumage golden green in various shades, the wings brown, and the under tail coverts white. From the ear coverts there are two tufts of produced feathers which extend downwards and backwards. Their colour in some lights is violet, but in others it is golden green; the female is of a very intense emerald green.

TUFTED-NECKED HUMMING-BIRD (*T. ornatus*). — This is a very singular species, especially in the ornamental feathers of the male, which appear in the shape of a large crest covering the whole upper part of the head, and in two tufts of produced feathers originating in the sides of the neck, and in shape and size bearing some resemblance to vines. We believe it is the species marked in the plate HUMMING-BIRDS, by mistake, as *T. auratus*, which should have been the last-mentioned species, save one, and named *auritus*. The male has the crest and produced feathers of bright brownish red, with a circular spot of pure green on the tip of each feather. The throat and breast are brilliant green, surrounded by a margin of chestnut. The upper parts are bronze green, with blue reflections, the under part purplish green immediately below the chestnut border, and passing into a deeper tint on the belly. The rump is greyish white;

the centre feather of the tail greenish, and the lateral ones chestnut red. The female wants the produced feathers, has the gorget pale chestnut, and the tail feathers red crossed by a broad bar of green.

THE SHIELDED HUMMING-BIRD (*T. scutatus*) has the forehead and gorget green, with a large tuft of deep blue feathers of a downy consistency, and tipped with yellow at the extremities on each side of the neck. These are not found in the female.

DELAND'S HUMMING-BIRD (*T. Delalandii*). The male of this species is one of the most singular of the whole, especially in the form of its crest, from the centre of which there rises one long and narrow feather of a bright blue colour, and white at the tip. The upper part is bright green, the under part rich blue, the flanks and sides of the neck grey, and there is a white spot composed of two or three scaly feathers over each ear covert. This species is found in Brazil. There is another species found in the same country which resembles this one in the form of the crest on the male, but the colours are different.

STOKE'S HUMMING-BIRD (*T. Stokeii*). This is, perhaps, one of the most splendid of the whole tribe; and the circumstance of its being found in the remote island of Juan Fernandez, rendered celebrated by the romance of Robinson Crusoe, tends to heighten the interest. If De Foe in forming his romance had been aware of the existence of this splendid little bird, he would have, no doubt, turned it to great advantage. This species is about four inches and a half in length, of which the body and head occupy about two inches. The head is adorned with a crest of scaly feathers, of a rich blue colour, with purple reflections; the whole of the upper part from the nape to the tail coverts is bright emerald green, the feathers scale-shaped, and increasing in size as they approach the tail, where the termination of the coverts is well defined. The tail consists of ten feathers, which are long and remarkably strong in proportion to the size of the bird; the two middle ones are wholly green, the others are green on their outer webs, and white on their inner, except the outer ones, which have only the distal half of the outer web green. A patch under and behind the eye is purple with green reflections, and dotted over with circular spots of metallic lustre, which are variable from pale pink to deep violet, as the light is differently reflected. The under part is white, with a greenish tinge on the chin, and marked all over with eye-shaped spots of bright emerald green. Altogether the plumage of this bird is exceedingly rich.

VIOLET-CROWNED HUMMING-BIRD (*T. sephanoides*). This is a migrant species in South America, at least in the southern parts. It is about four inches long, rather compactly made; has the bill straight; a flat purple crest on the head; the upper part golden green; the under part yellow on the throat, white on the sides of the neck, and reddish white on the breast and belly. The feathers on the fore neck and breast are scale-shaped, and each of them is marked with a circular brown spot. These birds, though migrant in Chili, are described as being very hardy.

RUBY-CRESTED HUMMING-BIRD (*T. moschitus*). This is a very common species; but it is peculiar in its attitude, and its colouring is exceedingly rich, and varies greatly in different lights. It is between three and four inches in length, but stoutly made, and has the bill long and strong. There is no produced crest, but the feathers on the upper part of the head to the nape, and also those on the under part of the body

and sides of the neck, are scale-shaped, and remarkable for the countless number of tints which they display. The top of the head and neck are well defined in their contrast with the adjoining plumage; but it is difficult to say what is the real colour; when the light is simply reflected, the colour is dull reddish brown; when it falls a little slantingly, so as to produce refraction, the lustre becomes metallic; and when the light falls so obliquely as to bring out the full reflection, the colour is rich ruby red, and the lustre not inferior to that of the gem. The scaly feathers on the throat and breast are dull greenish brown by simple reflection; but different refractions bring them up through every tint of golden green to a fine topaz yellow. The remaining parts are rich brown, except the vent feathers, which are white. The wings are purplish brown with faint reflections of green; and the tail, which is very large and strong, and capable of very extended and rapid motion, is delicate reddish brown, with a dark crescent-shaped border on the extremity of each feather. This species is very generally distributed, being found in almost all the West-India islands, and also generally over the continental part of tropical America. It builds a very neat nest, constructed of small bits of lichen externally, and neatly lined with vegetable down. The female differs considerably from the male. It is small, and bright golden green above, with the two middle feathers of the tail bronze green, and a bar of the same on the other feathers near their basis, while the tips, which in the male are darker than the rest of the feathers, are white in the female. The female also wants the rich scaly feathers, and is greyish brown on the under part.

MAGNIFICENT HUMMING-BIRD (*T. magnificus*). The application of superlative names either to birds or to flowers is generally rather an unfortunate matter; for it very frequently happens that after the finest name that can be thought of has been given to one species, another species of far greater beauty is discovered, to which only a common name can be applied. This is the case with the present species of humming-bird, which is much inferior, both in form and in plumage, to many of the others. It is golden green above, the same colour but much less bright on the under part, emerald green on the throat, and gorget, and the crown in the male, which is chestnut for part of its length, and then white with black tips to the feathers. The female is without the crest, and has the gorget chestnut colour. It is a Brazilian species.

RED-NECKED HUMMING-BIRD (*T. rufus*). This species is not so brilliant in its general plumage as some of the others; but the colours are finely contrasted, and the shape of the bird is handsome. The cap, which reaches only to the top of the head, and the feathers on the turn of the wings, are green. The general plumage of the body is salmon colour, fading into greyish white on the breast. The gorget of scale-shaped feathers, which extends on each side, of a brilliant cinnamon red, which varies in different lights. The female is greenish in the general plumage, except a few spots of cinnamon colour on the breast.

GOULD'S HUMMING-BIRD (*T. Gouldii*). This is a singularly formed and very handsome species, found somewhere in tropical America, but the particular locality is not known. In the form of its body and its ornamental feathers, it resembles the tufted-necked species, which we have already described; but it is

very different in the colours of its plumage. The forehead is green, the crest bright red, of a chestnut tinge, the scaly feathers on the breast very bright green, the wings and external feathers of the tail greyish purple, the back and middle tail feathers golden green, and the under part dark brownish green; the tufts which spring from the sides of the neck are, however, the most singular parts of the plumage. They are large, shaped something like the wings of a butterfly, of a pure white, with the exception of the tips, which terminate in perfectly circular spots of brilliant green. These spots form a border round the under edges of the tufts; and there are a few feathers in front, which are much shorter than those that give shape to the tuft, and unequal in their lengths, so that they form detached green spots upon the white ground of the tuft. This species, as is indeed the case with the greater number, is known only as a museum specimen; but it is presumed to inhabit the same countries as the tufted-necked one, which it resembles in so many respects.

DUCHESS OF RIVOLI'S HUMMING-BIRD (*T. Anna*). This species is an inhabitant of California, and has only been known for a few years, while its habits are still unknown to us. It is not quite three inches and a half in length, of which the bill and tail make up nearly one half, so that the body is small. It is a compact little bird, however, and powerfully winged. The most characteristic marking is the cap on the head, which is united to the gorget, with the exception of a black streak extending from the eye forward to the gape. This cap descends toward the nape, is produced in a large lobe on each side of the neck, and scalloped in the lower margin of the throat. It is composed of scale-shaped feathers, small at the base of the bill, but gradually increasing in size to the termination, where each feather forms a scallop. The colour is very rich purple red, changing into various tints in different lights. The upper parts, including the rump and the lesser coverts of the wings, are bright golden green; the wings are purplish brown; and the tail, which is slightly forked, is brown, with the exception of the two middle feathers, which are bronzed green, with bright metallic reflections. The under part is yellowish white immediately below the gorget, passing into greenish grey on the belly, and into whitish on the under tail coverts. Enough of the manners of the bird are not known for enabling us to determine whether it is resident in California all the year round, or only a summer visitant, as the northern humming-bird is in the United States, and the other species, which appear farther north on the west coast of North America, are understood to be.

GOLDEN-GREEN HUMMING-BIRD (*T. prasina*). This is a very small species, but it is remarkable for the intensity of its colour, and the energy of its expression. The body and tail are about two inches in length, and the bill is nearly two-thirds of an inch; the wings are long; the tail is stout, and strongly supported by coverts; the crown of the head and the throat and breast are covered with scale-shaped feathers; and there are produced feathers on the sides of the neck, consisting of a pointed row downwards from the eye, and a row of scale feathers from the base of the bill, passing immediately in front of the former; then a series of three or four enlarged scale-shaped feathers turned backward from the gorget as far as the scapulars. With the exception of the vent feathers, which are whitish, the whole plumage is of

a very deep golden green, but brilliant in the lustre, and varying in different lights from greenish golden yellow to intense blue. The scaly feathers on the crest and gorget are the most brilliant. The tarsi and toes of this species are remarkably small, but very neatly formed. The female and the young are supposed to be without the rich gorget, and to have the under part more or less white; but they are very imperfectly known; and it is not improbable that some of them have been described as different species.

BLUE AND GREEN HUMMING-BIRD (*T. cyaneus*). This species is also a native of Brazil, and nearly of the same length as the former, only the tail is shorter, and though not so handsomely formed, it is a stouter bird. The bill is very nearly straight, of a bright yellow colour, a little enlarged at the base, and again near the tip, but with the points of the mandibles very sharp. The top of the head is dull green, but in particular lights it changes to the most intense ultramarine blue. The throat is of varying grey and blue, according as the light falls. The breast is nearly the same colours as the top of the head; the upper parts are golden green, with reflections of blue in some lights; and a streak from the eye to the shoulder on each side of the neck changes to golden yellow in some lights. The belly is brownish green; the tail feathers blackish blue; and the wings purplish grey. Nothing whatever is known of the plumage of the young or the female.

There are two or three other Brazilian species which resemble, in many respects, one or another of those last enumerated as inhabiting that country; but as they are known only as museum specimens, and are rare as such, we cannot be certain whether they are really species or merely some of the others in different states of plumage. There still remain one or two species, however, of this division which deserve notice, from the peculiar structure of the bill, which is curved upwards at the tip, nearly in the form of that of the avocets; but what particular purpose this singular form of bill serves in the economy of the birds has not been ascertained. So far as is known, they are found only in the Andes, and chiefly in Peru. They are both rare, and not much is known of their history. The two differ considerably in the markings of their colours, and the contour of the head, and also in the curvature of the bill; but in size, in general structure, and in the air and expression of the body, they are so much alike as to warrant us in concluding that there is a great similarity in their manners.

AVOCET-BILLED HUMMING-BIRD (*T. avocetta*). This is not a large species, but it is stouter both in the body and the legs than most of the humming-birds. It measures about three inches and a half in length, of which the bill takes up rather more than half an inch. The bill is very strong for the size of the bird, of a black colour, straight in the greater part, but turned upwards at the tip, where both mandibles are flattened, and very fine and sharp at the points; the gape extends far backwards, nearly to the eye, though under it in position, and indicates that the bird is in the habit of opening its bill widely for some purpose or other; the crown of the head, and all the upper parts generally, including the lesser coverts of the wings, are golden green, passing into greyish white along the sides of the neck, the shoulders, and the flanks; and backward to the under tail coverts; the chin, throat, and upper part of the breast are emerald

green; and the middle of the belly is black. The nest and the habits of the bird are entirely unknown.

RECURVED-BILLED HUMMING-BIRD (*T. recurvirostris*). This is a much more beautiful species than the former, and the shape of its bill differs still more from that of the majority of the family. It is longer by nearly one half, being about three quarters of an inch, while the entire length is only three inches and a quarter. Thus the body, exclusive of the tail, is little more than an inch long. The bill is strong and black, slightly curved downwards in the basal half of its length, but recurved upwards, beginning at about one third from the tip. From the beginning of the recurvature to within a short distance of the tip, the upper mandible is furnished on each side with small teeth reflected backwards, evidently showing that the bill is formed for seizing some solid substance, probably insects of some description or other, but of what kind or in what situation it is not easy to say. The whole anterior and upper part of the body is brilliant green, with rich metallic reflections, bluish in the tint on the upper part, and bright emerald on the throat and breast. The flanks are also pale golden green, ending in scallops at their under edge; and the middle of the belly is greyish white; the downy feathers upon the tibiae and the vent feathers are pure white; the tail is long and strong, but wedge-shaped; they are of various colours, being golden green in the middle, bluish at the sides, and showing bright copper or bronze reflections in some lights; the tarsi and toes are marked with alternate narrow rings of light and dark colour; the wings are very long, and falchion shaped, and of a blackish purple colour. We shall quote a short passage from Mr. Swainson, with reference to this and the preceding species. "The extraordinary formation," says Mr. S., "in the bill of this beautiful little creature is without parallel in any land bird yet described, and presents in miniature a striking resemblance to that of the avocet. It is almost impossible to conjecture rightly the use of this singular formation; but it appears to me not improbable that the principal sustenance of the bird may be drawn from the pendent bignoniaceæ and other similar plants, so common in South America, whose corollæ are long, and generally bent in their tube; the nectar, being at the bottom, could not be reached either by a straight or curved bill, though very easily by one corresponding to the shape of the flower.

"Bill black, depressed along the whole length, but more especially at the tip, which is rounded, thin, obtuse, and recurved in both mandibles, the under of which, towards the middle, has a convex swelling, which gives the recurvature a stronger appearance. All the upper plumage and body beneath golden green; from the breast to the vent is a stripe of black down the middle; thighs white; tail even; the two middle feathers dull greenish blue, the rest above obscure coppery brown, but beneath of a rich shining topaz colour."

SUB-DIVISION II.—Cyanthus. The birds of this subdivision also have the bill straight, or nearly so; but they differ from the former in having the tail very long and forked. They appear to range over a greater extent of latitude than those of the first subdivision.

NORTHERN HUMMING-BIRD (*C. colubris*). This species gets its common English name from being found in situations much more northerly than any of the others. It is the one which was first known in

this country, from its being so plentiful in North America; and for a considerable time it was the humming-bird. It is still the one with whose manners we are best acquainted. Its colours are, golden green above, golden red on the throat, very fine purple brown on the wings and tail, and white on the under part. It is a very beautiful species; and its whole length, from the tip of the bill to the extremity of the tail feathers, is not three inches and a half. In the southern parts of America it is stationary for the whole year; but it is a much more discursive bird than most of its congeners, and ranges seasonally over a considerable extent of latitude, breeding as far to the northward as Canada in the summer season, but retiring not only from the extreme north, but, generally speaking, from the whole country northward of the Gulf of Mexico during the winter. It makes its appearance in the southern states of America about the time of the vernal equinox, but it is at least a month later in arriving in the middle states, and it does not reach Canada till the summer has commenced. In the middle states it begins to construct its nest about a month after its arrival. The best description which we have of its manners is, of course, that given by Wilson, and therefore we shall not attempt to substitute another in place of it. "The nest is generally fixed on the upper side of a horizontal branch, not among the twigs but on the body of the branch itself. Yet I have known instances where it was attached by the side to an old moss-grown trunk; and others, where it was fastened on a strong rank stalk, or weed in the garden; but these cases were rare. In the woods it very often chooses a white oak sapling to build on; and in the orchard garden selects a pear-tree for that purpose; the branch is seldom more than ten feet from the ground. The nest is about an inch in diameter, and about as much deep; the outward coat is formed of small pieces of a small species of bluish grey lichen, that vegetates on old trees and fences, thickly glued over with the saliva of the bird, giving firmness and consistency to the whole, as well as keeping out moisture; within this are thick matted layers of the fine wings of certain flying seeds, closely laid together; and, lastly, the downy substance from the great mullein, and from the stalks of the common fern, lines the whole. The base of the nest is continued round the stem of the branch, to which it closely adheres; and when from below appears a mere mossy knot, or accidental protuberance. The eggs are two, pure white, and of equal thickness on both sides. On a person approaching their nest, the little proprietors dart around with a humming sound, passing frequently within a few inches of one's head; and, should the young be newly hatched, the female will resume her place on the nest even while you stand within a yard or two of the spot. The precise period of incubation I am unable to give; but the young are in the habit, a short time before they leave the nest, of thrusting their bills into the mouths of their parents, and sucking what they have brought them. I never could perceive that they carried them any animal food, though from circumstances, which will presently be mentioned, I think it highly probable that they do. As I have found their nests with eggs so late as the 12th of July, I do not doubt but that they frequently, and perhaps usually, raise two brood in the same season.

"The humming-bird is extremely fond of tubular flowers, and I have often stopped, with pleasure, to

observe his manœuvres among the blossoms of the trumpet-flower. When arrived before a thicket of these that are full blown, he poises or suspends himself on wing for the space of two or three seconds, so steadily, that his wings become invisible, or only like a mist; and you can plainly distinguish the pupil of his eye looking round with great quickness and circumspection; the glossy golden green of his back, and the fire of his throat, dazzling in the sun, form altogether a most interesting appearance. When he alights, which is frequently, he always prefers the small dead twigs of a tree, or bush, where he dresses and arranges his plumage with great dexterity. His only note is a single chirp, not louder than a small cricket or grasshopper, generally uttered while he passes from flower to flower, or when engaged in fights with his fellows; for, when two males meet at the same bush, or flower, a battle instantly takes place; and the combatants ascend in the air chirping, darting, and circling around each other, till the eye is no longer able to follow them. The conqueror, however, generally returns to reap the fruits of his victory. I have seen him attack, and for a few minutes tease, the king bird; and have also seen him, in his turn, assaulted by an humble-bee, which he soon put to flight. He is one of those few birds that are universally beloved; and amid the sweet dewy serenity of a summer's morning, his appearance among the arbours of honeysuckles, and beds of flowers, is truly interesting.

When morning dawns, and the blest sun again
Lifts his red glories from the eastern main,
Then through our woodbines, wet with glittery dews,
The flower-fed humming-bird his round pursues;
Sips, with inserted tube, the honey'd blooms,
And chirps his gratitude as round he roams;
While richest roses, though in crimson drest,
Shrink from the splendour of his gorgeous breast.
What heav'nly tints in mingling radiance fly!
Each rapid movement gives a different dye;
Like scales of burnish'd gold the dazzling show,
Now sink to shade—now like a furnace glow!

"The singularity of this little bird has induced many persons to attempt to raise them from the nest, and accustom them to the cage. Mr. Capper, of Fairfax county, Virginia, a gentleman who has paid great attention to the manners and peculiarities of our native birds, told me that he raised and kept two for some months in a cage, supplying them with honey dissolved in water, on which they readily fed. As the sweetness of the liquor frequently brought small flies and gnats about the cage and cup, the birds amused themselves by snapping at them on the wing, and swallowing them with eagerness, so that these insects formed no inconsiderable part of their food. Mr. Charles Wilson Peale, proprietor of the museum, tells me, that he had two young humming-birds, which he raised from the nest. They used to fly about the room; and would frequently perch on Mrs. Peale's shoulder to be fed. When the sun shone strongly into the chamber he has observed them darting at the motes that floated in the light, as fly-catchers would after flies. In the summer of 1803, a nest of young humming-birds was brought me, that were nearly fit to fly. One of them actually flew out by the window the same evening, and, falling against a wall, was killed. The other refused food, and the next morning I could but just perceive that it had life. A lady in the house undertook to be its nurse, placed it in her bosom, and, as it began to revive, dissolved a little sugar in her mouth, into which she thrust its bill, and

it sucked with great avidity. In this manner it was brought up until fit for the cage. I kept it upwards of three months, supplied it with loaf sugar dissolved in water, which it preferred to honey and water, gave it fresh flowers every morning sprinkled with the liquid, and surrounded the space in which I kept it with gauze, that it might not injure itself. It appeared gay, active, and full of spirit, hovering from flower to flower as if in its native wilds, and always expressed, by its motions and chirping, great pleasure at seeing fresh flowers introduced into its cage. Numbers of people visited it from motives of curiosity, and I took every precaution to preserve it, if possible, through the winter. Unfortunately, however, by some means it got at large, and, flying about the room, so injured itself that it very soon died.

"This little bird is extremely susceptible of cold, and, if long deprived of the animating influence of the sun-beams, droops and soon dies. A very beautiful male was brought me this season (1806), which I put into a wire cage, and placed in a retired shaded part of the room; after fluttering about for some time, the weather being uncommonly cool, it clung by the wires, and hung in a seemingly terrified state for a whole forenoon. No motion whatever of the lungs could be perceived on the closest inspection, though at other times this is remarkably observable; the eyes were shut, and, when touched by the finger, it gave no signs of life or motion; I carried it out to the open air, and placed it directly in the rays of the sun, in a sheltered situation; in a few seconds respiration became very apparent, the bird breathed faster and faster, opened its eyes, and began to look about with as much vivacity as ever. After it had completely recovered, I restored it to liberty, and it flew off to the withered top of a pear-tree, where it sat for some time dressing its disordered plumage, and then shot off like a meteor.

"The flight of the humming-birds, from flower to flower, greatly resembles that of a bee, but is so much more rapid, that the latter appears a mere loiterer to him. He poises himself on wing, while he thrusts his long slender tubular tongue into the flowers in search of food. He sometimes enters a room by the window, examines the bouquets of flowers, and passes out of the opposite door or window. He has been known to take refuge in a hothouse during the cool nights of autumn, to go regularly out in the morning, and to return as regularly in the evening, for several days together."

The great extent of country over which this little creature passes, and the severe and almost incessant labour it undergoes, considering its very minute size, are not among the least wonderful facts in the whole history of animated nature. Upon examining a little more closely, we find some circumstances connected with it, which would convince us, if such a conviction were necessary, that the energy of animals, taken in their whole economy, is always in proportion to the development of its circulating system. The heart of this little bird is perhaps larger in proportion to the whole size than that of almost any other animal, in order that the rapidity of circulation, which is essential to the performance of the great and continued muscular efforts which the bird must make, may be supported by a corresponding nervous energy; the brain is also very large in proportion to the size of the bird; the stomach, on the other hand, is remarkably small, equal to a small fraction of the heart only, which

is very different from the relative size of the two organs in the majority of animals. In almost every specimen of this species which has been observed with sufficient attention, the stomach has been found to contain chiefly insects and their remains, which leaves no doubt as to the principal food of at least this species of humming-bird. One of the most extraordinary circumstances connected with it, is the varying colour of the plumage of the throat. We have mentioned golden red as the general tint, but according as the light falls on it, it varies through every hue, from deep black, in every imaginable shade of red and green, up to a glow of light, bearing some resemblance to the white heat of an intense furnace; and every one of those countless differences of colour has the same radiance of metallic mixture.

BLUE-THROATED HUMMING-BIRD (*C. Lucifer*). This is a very beautiful and delicately formed bird, with the bill very long, and slightly arched. The upper part is bright yellowish green, passing into greenish on the flanks, and into a tint nearly white on the under part of the body, which tint is purest on the sides of the neck, and contrasts well with the hind neck, where the green is deepest. The most striking character of the bird, however, is the ornamental feathers of the male; these consist of small car-tufts of pale feathers directed backward, and not remarkable for their beauty; but the gorget under the throat, hanging down over the front and sides of the neck, is very splendid: it consists of well defined scale-shaped feathers, rounded at their extremities, and very neatly imbricated. The medium colour of these is a very pure bluish violet; but according to the refraction of the light, the colour varies from a fine pink to the most intense ultramarine blue. The wings are long and falchion shaped, of a brownish purple colour, and slightly bordered with whitish; the tail feathers are nearly of the same colour as the wings, with the exception of the middle ones, which are greenish yellow; the tail is much forked, and the lateral feathers are sharp pointed, with a little portion of the inner web, toward the tip, white. This species has been found in Mexico, but neither the female nor the nest has been described.

AMETHYST HUMMING-BIRD (*C. amethystinus*). This is a very beautiful species, and has been long known as a native both of Brazil and of Guiana. Its bill is long and straight, and its whole form neat; the upper parts are bright golden green, and the under grey, passing into greyish white on the lower part of the neck, and the under tail coverts. This last colour forms a sort of crescent round the lower margin of the gorget, which is composed of very compact scaly feathers, of a bright amethyst colour; the tail is deeply forked, and the lateral feathers slender and pointed. This is the marking of the adult male; but in the young birds there are considerable varieties of colour, and also in the form of the tail; in them, the feathers on the chin and throat have not the form of scales, and they are white; the tail also is not forked; the colour of the breast is gradually acquired; and so is the fork of the tail. In consequence of these changes, the bird is liable to be considered as several species; and there are, if not some varieties, at least some species, nearly resembling this one, of which specimens have occasionally been seen. The chief difference is in the colour of the gorget, which approaches to a ruby colour in some of them, while in others it has less of the reddish tint than occurs in the

common amethyst colour. There is, however, a good deal of confusion about these birds, arising from their agreement in some respects, and their difference in others; and a great deal of additional observation will be required before this confusion will be removed.

WHITE-EARED HUMMING-BIRD (*C. leucotis*). This is a Brazilian species, of small size, but handsome and peculiar in its markings; the length is not more than three inches; the bill is not very long, of a yellow colour, and slightly arched; the forehead, before the eye, the chin, cheeks, and upper sides of the neck, are azure blue, less conspicuous in the tint on the forehead where the feathers are small, but becoming more brilliant downwards, as the feathers get larger in size; the colour on the side of the head to the rear of the eye, is broken by an arch of white which passes over the ear covert, and curves downward, the one nearly meeting the other on the back of the neck. It is from the last marking that it receives the name of white-eared. The gorget on the lower neck and breast is bright verdigris, or slightly bluish green; the hind head is brownish violet, which gradually blends with the golden green on the back; the under part is brownish green, with a trace of grey; the quills of the wings purplish; the tail feathers, which are nearly even at the extremity, of the same colour as the upper part of the bird; and the vent feathers and under tail coverts pure white. It is by no means common in Brazil, and specimens of it are rare in European collections.

EVENING HUMMING-BIRD (*C. vesper*). This species has been observed chiefly in the southern Andes, or at least in those elevated plains which lie between those mountains and the sea. Some of the colours of this species are more subdued than they are in most of the others; but they are beautifully contrasted. The bill is long, slightly curved and enlarged near the point. The upper part is oil green, passing into more of a golden green on the middle of the back and the rump, but without metallic reflections. The breast and belly are white, and so are the under coverts of the tail; but the flanks and the vent feathers are greyish. There is a small streak of white behind the eye, and another behind the gape; the wings and tail are deep purplish black, both very long, and the tail much forked. The most beautiful part of the bird, the gorget, which covers the chin and fore neck, consists of scale-shaped feathers, and is of that peculiar reddish violet, which changes into bright ruby in the one extreme of reflection, and into rich sapphire blue in the other.

RACKET-TAILED HUMMING-BIRD (*C. platurus*). — There are two distinct species of these birds, both of which have that peculiar structure of the exterior feathers of the tail upon which the trivial name is founded,—namely, the feathers very elongated, and the webs gradually tapering away till they are almost obliterated, and then spreading again into an oval disc, which is very distant, not only from the body of the bird, but also from the other feathers of the tail, which, for nearly as long as the body exclusively of the bill, are not half the length of the racket feathers.

These two species are, the racket-tailed humming-bird, with the tarsi the same as in the rest of the family; and the rough-legged one, with the tarsi feathered down to the toes, or at least clothed with a downy covering in very considerable quantity.

The racket-tailed humming-bird is deep and

rather dull green on the upper part, of uniform tint throughout; it is dull brown, with a greenish tinge, on the under part; the vent and under coverts of the tail are pure white; and the chin and throat and upper part of the breast are covered with a gorget of very bright emerald green. The two outside feathers of the tail extend to twice the length of the others, tapering gradually for the greater part of their length, and then terminating in firm broad discs of a black colour, which are nearly round. The wings are long, narrow, and falchion-shaped. Enough is not known of the habits of this singularly formed bird for enabling us to ascertain whether the female also possesses those racket feathers, or whether they are peculiar to the male. Analogy, however, would lead us to conclude that the latter is the case; because there are comparatively few birds in which the female has any supplemental feathers in the tail. The remaining tail feathers are gradually shorter towards the middle, and form a slight fork; but when the racket feathers are taken into account, the tail is very much forked. These birds are rare, and little is known respecting them, farther than that they have been brought to Europe from Guiana.

The rough-legged humming-bird is more handsome in the colouring than the smooth-legged racket-tail. All the upper parts are very rich golden green, with the exception of a white bar on the rump; and the two middle feathers of the tail are of the same colour. The gorget, which is very bright emerald green, descends far down on the breast, as does also the green of the back on the sides and flanks, which passes into deep brownish green on the middle of the belly. There are feathers on the tarsi, and also on the tibiae, and though those feathers are formed of very small filaments, those filaments are not downy, like the feathering on the tarsi of the birds of cold countries. They partake of that firmness of texture which characterises the general plumage of the humming-birds. This covering of the feet is a peculiarity among birds; and therefore it is to be regretted that we do not know either the habits, or the native country of this species, farther than that it is American; and, therefore, we can form no conclusion respecting the purpose which this formation, of which it is the solitary instance in a very numerous family, answers in the economy of the bird. Besides the difference in the colour and the more remarkable difference in the tarsi, of which we have taken notice, there is a considerable difference in the shape of the rackets in which the tails of these birds terminate; in the one with a naked tarsi, these are nearly round; but in the other they are oval, or rather sub-oval, with pointed extremities.

HALF-TAILED HUMMING-BIRD (*C. erricurus*). This is a very gracefully formed, though remarkably slender bird. It measures about four inches and a quarter in length, of which more than one half is occupied by the tail, and at least a third of the remainder by the bill. The bill is slender, a little enlarged near the tip, but remarkably sharp pointed. It is very slightly bent. The body is elongated, and gracefully tapered off towards the tail. The tarsi and toes are very slender. The upper parts of the body, including the coverts of the wings, and the two middle feathers of the tail, as well as the last coverts of the tail, which, though short, consist of two feathers similar in structure to the others, are golden green; and all the under part from the middle of the breast, including the

under coverts of the tail, is of the same colour. The gorget is rich purple, or ultramarine blue in some lights, and formed of scaly feathers; below it there is an irregular band of white, extending backwards on each side of the neck till the two ends nearly meet; and below this there is a pretty large patch of bright yellow, broadest on the breast, but extending on the sides of the lower neck and the shoulders as far back as the patch of white. The wings and tail are purple brown; the former long in proportion to the size and weight of the body, but short as compared with the tail. The tail itself is the most remarkable part of the whole structure; and is not very well expressed by the English epithet, half-tailed. The French name "singular" is more expressive of it; because all the appendage that nature bestows upon any particular species of bird is, of course, a whole tail, whether it consists of a number of feathers or of one only. This one consists only of six, unless we are to admit the last coverts to be reckoned as tail feathers; and even the two longest of those green ones are so short in comparison that they appear like coverts to the produced ones; and they do this the more by being of the same colour with the back; while the produced ones, being of the same purple brown as the wings, contrast strongly with them. The external tail feathers are the longest, and they diverge at the points; while the other two reach to about two-thirds of their length. All these four feathers are narrow, and of equal length throughout, only they are rounded off at the points. By a very little contrivance, a figure of this bird may be readily converted into a most ludicrous caricature of a human being. All that has to be done is to turn the figure with the tail feathers directly downwards, lay a little slip of paper over the head and neck of the bird as far as the shoulders, continue the same tint of green upon the paper in the form of the collar of a coat, paint the back of a human head above this collar, and the caricature is complete,—representing a most singular being with a green coat and epaulettes, and purple brown sleeves, with trowsers of the same upon long stilt-like legs; for the skirts and pocket-flaps of the coat are very well made out by the two green tail feathers and their coverts.

BAR-TAILED HUMMING-BIRD (*C. sparganurus*). This is a most singular species, and considerably larger than many of the others. It is understood to inhabit a considerable extent of the table-land of the Andes, both in Mexico and Peru; but it has not hitherto been found in any of the coast countries or the islands. The bill is a little bent, awl-shaped, and very sharp at the point. The upper parts are golden green, with a slight tinge of purplish brown; the under part from the bill to the middle of the belly is bright emerald green, peculiarly rich on the middle of the throat, and composed of scaly feathers which extend along the whole of the breast. The lower part of the belly is all green, and the vent feathers greyish white. The rump is clear and rich red, but without any metallic lustre, and the feathers have not a scaly appearance. The tail, however, is the most singular part of this bird. It consists of two parts, standing at an angle to each other like the letter V. The outside feather in each branch is very long, not less than six inches. The second feather is only about three inches and a half, the third a little more than two inches, the fourth shorter than that, and the last one about three quarters of an inch. The principal colour of these

feathers is bright reddish orange, of a very brilliant metallic lustre, and varying in different lights through different shades from red to yellow. There is a black bar across the end of each feather, which shortens as the feathers shorten. This bar is carried down the outer margin of every feather except the first and second, and the basal two thirds of the first has also the outer margin black. Where the margin is black, the shaft of the feather is also black, and where there is no black margin, the shaft is relieved by a slender black line upon each side. Altogether, it is one of the most singular appendages to be met with in the whole feathered creation; and though we are not very well informed with regard to the manners of many of the family, the strong fortification of coverts which this tail possesses would lead us to conclude that it is capable of some corresponding action which is essential to the economy of the bird.

NUNA HUMMING-BIRD (*C. Nuna*). This species has some resemblance to the preceding one in its general form, and the development of the several parts, especially the tail, but it is of much smaller size, the bill and body only measuring two inches, and the tail three. In its colouring it is very beautiful. The whole of the upper part is a fine emerald green, with rich golden reflections, and the general ground colour of the under part is pure white. But this under part is very beautifully marked with circular spots of emerald green, one upon the tip of each feather, and these show very richly upon the pure white ground. These are most perfect, and become gradually faint and clouded towards the lower part of the belly, till the colour passes gradually into bright chestnut on the under coverts of the tail. The tail feathers are of considerable breadth for the size of the bird, and they increase in length from the middle to the outer ones, in the same manner as in the bar-tailed species. The colours are, however, more varied. The middle ones are purple brown on the basal part, steel blue beyond that, and terminated by a bar of very beautiful green. The lateral feathers have the tips deep steel blue, and the outer web white for the basal half of their length. The young have the colour broken by grey on the upper part, and brownish red on the under. Hitherto, we believe, specimens of this very handsome species have been obtained only from Peru; but it is probable that they occur also in Brazil.

LANGSDORFF'S HUMMING-BIRD (*C. Langsdorffii*). Is a Brazilian species, and as remarkable for its beauty as for the singular form of the tail feathers. The bill is of moderate length, very slender and depressed at the base. The upper part is a delicate subdued golden green; the gorget consists of scale-formed feathers of the same general tint, but giving out brilliant reflections in different lights. On the under part, this is bordered by a crescent of bright orange, which has reflections of golden yellow and of red. The lower part of the breast is intense blue; the belly brownish violet; and the vent feathers, under the tail coverts, pure white, which ascends on the hinder part of the flank, and, uniting on the lower part of the back, separates the green on the rump from that on the rest of the body. The wings are purplish grey with a dash of orange on the turn. The tail feathers are ten in number, six in the middle, which are deep blue, broad at the bases and narrow at the points, the two middle ones comparatively short, and the others longer and more pointed in suc-

cession. The most singular part of the tail, however, is the four remaining feathers. These are of the same colour as the wings, and taper gradually to perfect points, the inner pair being nearly twice the length of the blue feathers, and the outer pair a good deal more. This peculiar production of the tail feathers is characteristic of the mature birds only, as is also the brilliant green and the orange crescent on the throat and breast. The outline of this species is particularly graceful.

BLACK-CAPPED HUMMING-BIRD (*C. polytmus*). This is another very elegant species, remarkable for the length to which the feathers of the tail are produced. It has been procured for this country chiefly from the island of Jamaica, where it is far from being rare; but it occurs also in many others of the West India islands, and also on the main land of South America. Estimated by the length, it is a bird of considerable size, for it measures nine inches from the extremity of the bill to that of the produced feathers of the tail. Of these nine inches, however, the tail occupies two-thirds, and the bill one-third of the remainder, so that the length of the body and head is reduced to two inches. The wings are long and powerful as compared with the size and weight of the body, but short as compared with the tail; and thus the bird, when it hovers about, has some resemblance to a dragon-fly on the wing. The bill is very slightly curved, lemon yellow for the greater part of its length, and black at the tip. The tarsi and toes are reddish yellow. The whole upper part of the head is covered with black feathers considerably produced, of a silky texture, and without any metallic reflections. The rest of the body, with the exception of the gorget and the under tail coverts, is rich golden green; the gorget is scaly, and emerald green of the utmost intensity of tint; and the under tail coverts are grey, with greyish purple tips. The wings are deep brownish black, with a tinge of purple. The tail is much forked, and consists of ten feathers; the middle ones are short, and three others on each side increase in length by nearly equal stages, while the two external ones reach beyond the longest of the others for a length nearly equal to that of the bill, body and other tail feathers taken together. They are rather narrow, but of uniform breadth throughout, and the produced part of them is flexible and waving. The general colour of the tail is brownish black with reflections varying from purplish grey to bright green. The female has the under part white, breaking with the green on the sides of the neck. The tail wants the produced feathers, and is green, with the exception of about half the length of each of the four external ones towards the tip, which is white.

DUPONT'S HUMMING-BIRD (*C. Dupontii*). This is a slender species, with the bill very long, and the tail of considerable length, though not so much so as in the previously noticed species. The entire length is about four inches, of which the bill and tail occupy nearly one half. The bill is long and slender, with very little curvature, and exceedingly sharp at the point; the upper part is yellowish green, of a glittering lustre, but not metallic; the gorget, which rises so high as nearly to include the eyes, and extends far back on the sides of the neck, consists of scaly feathers, and varies from intense black to rich deep blue, according to the light in which it is seen; the flanks and belly are pale brownish green, passing into whitish on the shoulders, and pure white on the vent; the tail con-

sists of ten feathers, extending by gradually increasing differences from the central ones, which are very short, to the external ones, which are rather long, and have their extremities slightly rocket shaped; they have white tips succeeded by fawn colour, and then by a reddish tinge at the base; the wings, with the exception of the lesser coverts, which are like the upper part, are purple brown, of mean length, very narrow, and falcion shaped. The bird is a native of Mexico, and probably also of some of the other elevated plains among the Andes.

SAPPHIRE-THROATED HUMMING-BIRD (*C. sapphirinus*). This is rather a showy species, about three inches and a half in length, of which the wings and tail occupy about a half; the body is stout for the size of the bird, and the wings are rather long; the bill is long, slender, very little bent, bright yellow for the greater part of its length, but black at the tip; the top of the head and all the upper parts of the body are rich golden green, which passes into brownish green on the flanks and belly, and into grey on the vent feathers; the chin is clear reddish chestnut, and below that there is an extensive gorget of beautiful sapphire blue extending down to the middle of the breast, and composed of scaly feathers; the extremity of the tail is nearly even, and the colour a uniform madder red. The female wants the red on the chin, and is every way duller in the colours. This species is pretty generally distributed, being found along the whole northern-coast of South America from Brazil westwards; and it is not rare in its localities.

WAGLER'S HUMMING-BIRD (*C. Waglerii*). In its form this bird bears some resemblance to the species last mentioned, but its colouring is very different. The whole plumage, including even the wings and tail feathers, is nearly of one uniform tint, namely, deep and rather dull emerald green, almost black in the shade, and inclining to a dull bluish tint on the quills and tail feathers. The body, however, possesses very rich reflections of blue and gold, according as it is turned to the light, and the quills and tail feathers furnish equally rich reflections of purple. The bill is long, perfectly straight, and slender; and the wings, though rather narrow, are long and falcion-shaped. The tail is strong and broad, composed of ten feathers, and forked at the extremity. This species is a native of Brazil.

SAPPHIRE AND EMERALD HUMMING-BIRD (*C. bicolor*). In form this species resembles the last-mentioned, but its colours are different. The green on the upper part is richer; and the colour of the throat, the breast, and the tail, is much bluer. The former indeed forms a gorget of very rich blue of bright metallic lustre, which fades gradually into bluish green on the belly. The tail is steel blue on both surfaces, and very little forked. The female has the throat and breast nearly white, and the rest of the under part only mottled with green. The young males have the blue gorget very dull, the flanks and vent feathers of a greenish black colour; and the whole plumage without that brilliancy which characterises the full-grown male. It is found in the low and rich countries in the north part of South America, and also in several of the West India islands; but it does not occur, or at all events has not been met with, in elevated countries, such as Mexico and Upper Peru.

FORKED-TAILED VIOLET HUMMING-BIRD (*C. furcatus*). This species is not so forked in the tail as some of the others; but as it happened to be the first forked-

tailed one which was known to Europeans, it has got possession of the name. It is four inches in length; and as the tail is not so long in proportion as some of the others, the body is longer, and it is also thicker. The upper parts are golden blue in the middle, passing into golden green on the wings and the tail, and into the same colour with a trace of brown on the head; the vent feathers are grey; the gorget on the throat is of a beautiful amethyst purple; the middle of the under part is pure white; and though the upper part generally appears blue in some lights, it appears golden green in others. It occurs pretty generally in the northern parts of South America, from Brazil westward, and also in the West India islands; but though it has been long known, its habits have not been ascertained, neither have the colours of the female or the young been accurately determined.

BLUE-BELLIED HUMMING-BIRD WITH TOOTHED BILL (*C. thalassimus*). This is a Mexican species, about five inches in length, with the tail very fully developed, and the wings very long, narrow, and bent. There is not a great deal of variety or strong contrast in the colours; but they are rich and beautiful. The general colour of the upper part of the body is very dark green, with golden reflections of rich metallic lustre. The gorget upon the centre of the throat varies from deep velvet black to bright emerald green, with metallic reflections; and this gradually passes into a fine azure blue on the ear-tufts. The tail is greyish blue with metallic lustre, and crossed by a bar of deep indigo blue near the extremity. The bill is slightly bent, and both mandibles are toothed for a short distance near the tip. The bill is of a black colour, as are also the feet. The young males are without the rich blue on the ear-tufts and the sides of the neck; and in them the whole of the upper part is mixed with greyish blue, much more than in those which are full grown. The female is understood to have the flanks and vent feathers dull grey, and the under tail coverts reddish white, and also to be without any of the rich blue on the sides of the neck or the lower part of the breast. This is rather a rare species.

GIGANTIC HUMMING-BIRD (*C. gigas*). This is the largest humming-bird which has hitherto been discovered. It is at least eight inches in length, and stoutly made, remarkable for the length and strength of its wings, and the firmness and regularity of its tail, which last organ is rather deeply but regularly forked at the tip. From its large size, it has been called "the Patagonian;" and it is rather curious that if it is not found actually within Patagonia, it is found close upon the borders of it. The first knowledge that was obtained of it in Europe was from a specimen brought by the gallant but unfortunate Lord Byron from the country of the Araucanians, the whole of which lies beyond the thirty-seventh degree of south latitude. It is also common in the interior of Chili, but it is understood to be rare nearer the equator, and not found in the northern parts of South America, though it was once considered as being a Brazilian bird. Its colours are not nearly so bright as many of the smaller species; and it is described as being without any brilliant gorget or produced feathers. It is an inhabitant of the wild woods, in which it is not frequently seen; and therefore its manners, or the changes of plumage it may undergo, are very imperfectly known. The top of the head, the back, and the coverts of the wings,

are brownish green, with green reflections; the under parts are of a dull pale reddish, mottled with a darker tint, and passing into dull green on the flanks. The head and upper part of the throat have a mottled appearance; and though there is no beauty of colour in the fore-neck, the feathers have the scaly form which belongs to the males of almost all the family; and as their margins are of a paler tint than the central parts, this part also appears slightly mottled. The tail consists of ten feathers, of a greenish brown colour, with reflections of golden green, but not very brilliant. Altogether, indeed, this bird is more sober in its plumage than almost any other of the family. It is, however, a very perfect model of a flying bird. The closed wings extend beyond the extremities of the tail, and their form and their feathers are alike fitted for the most vigorous flight. The pectoral muscles are also very large, in order to give motion to the powerful wings upon which the strength of the bird is concentrated. The feet, on the other hand, are remarkably small, and appear quite disproportioned to the size of the bird. In the male the quills of the wings are said to be violet brown, without any mixture of other colours; and in the female they are said to have pale russet colour on the margins; but there is a good deal of confusion about the descriptions of these birds.

There are a good many more species described as belonging to this sub-division; but some of them are doubtful, and all of them but little known, and therefore the list which we have given may perhaps be considered as sufficient for the general reader. It is only now that America, more especially the tropical and southern parts of it, is beginning to be examined with anything like zeal and science united; and as the harvest of discovery in the natural history of birds, and in every other department of nature, cannot fail in being very rich, we may confidently expect that, in the course of a few years, we shall be as well acquainted with the habits of American animals, and humming-birds among the rest, as we are now ignorant of them.

SUB-DIVISION III.—Phæthornis. The general characters of this sub-division are the bill long, tapering to the point, and considerably arched; and the tail long and wedge shaped, or stayed by each feather being a little longer than the one exterior of it, as in the magpie.

SUPERCILIOUS HUMMING-BIRD (*P. superciliosus*). The bill of this species is very long, and tapers gradually to the tip, being also considerably bent. The male and female differ considerably from each other in size, in the general colours of the plumage, and in the general form of the tail feathers; the upper part is bronzed green, with a brownish tint; the side of the head is marked by two patches of reddish white, one passing from the base of the upper mandible to the ear covert, and the other consisting of a spot immediately over the eye, and it is from the latter that the bird gets the name of supercilious, or eye-browed; the throat and upper part of the breast are covered with scaly feathers, but these have no brilliant tint, the whole of the under part being a subdued brownish white, very soft and delicate, but without much beauty; the tail is wedge shaped, but contains two produced feathers which extend an inch and a half beyond the others, and are very straight and narrow; the tail is bronzed green, deepening toward the extremities of the feathers, which are lancet shaped, and

have narrow borders of a paler colour ; the length of the bill, measured along the curve, is more than an inch and a half ; that of the body to the insertion of the tail is three inches, which last is also the entire length of the tail. The bird is thus rather more than seven inches and a half in length, but as three-fifths of this are taken up by the bill and the tail, the body is not large. The female, taken altogether, is much richer in the plumage than the male, which is very unusual in this family of birds ; the upper part is bronze green, as well as in the other, but the tint is clearer, and it is pleasingly variegated by narrow borders of brighter green on the points of the feathers ; the white streak under the eye is also brighter, but the spot above it is less conspicuous ; the under parts are of a deeper and finer brown, darkest on the chin, and becoming paler backwards ; the tail is rounded at the extremity, and very finely coloured ; the middle feathers are longer than the rest, but not produced, so as to break the general outline : they are bright green, with the exception of the tips, which are white, and immediately within the white tips there is a broad bar of the same green as the rest, but deeper ; the lateral feathers of the tail are reddish chestnut in the basal part, white at the tips, and have a black bar inside the white, which, along with the green on the middle feathers, forms a zig-zag band across the whole tail ; the length of the female is less than five inches, of which the body occupies one-half, and the bill and tail the other half, in equal parts. These birds are found in most of the rich parts in the tropical portion of South America.

SCALY-BACKED HUMMING-BIRD (*P. Eurynomus*). This is an elegant species, and alike remarkable for the peculiarities of its markings, and the form of its tail ; it has some resemblance to the last-mentioned species, but it is rather shorter, more slender in the body, and altogether much more elegant ; its total length, including that of the produced feathers of the tail, is about six inches and a half, and the bill and tail occupy considerably more than half ; the outline is altogether exceedingly elegant ; the bill has a slight, but very graceful curvature ; the tail is particularly handsome in shape ; and the wings, which are very long and powerful for the size of the bird, form graceful curves ; the head and nape of the neck are covered with scaly feathers of a brown colour, margined with chestnut ; the other upper parts are of a fresh green ; the plumes have the shape of scales, they are large, rounded, and bordered with a dull reddish tinge ; the principal streak on the ear coverts is black, above which, from the eye backwards, there extends a stripe of ochre yellow, separating this black from the brown and chestnut feathers on the head and nape, and a similar line extending from the gape below the eye and the ear coverts ; the chin and throat are covered with scaly feathers, brown in the centre, and margined with ochreous yellow ; the neck, breast, belly, and flanks, are brownish grey, with a reddish tinge ; the lower tail coverts are reddish chestnut ; the tail is of a wedge shape ; the centre feathers are green, very long and narrow, with the projecting tips white ; at the base, the other feathers are of a deep black, with white tips, which extend to nearly half their length. It is a Brazilian species.

GUY'S HUMMING-BIRD (*P. Guy*). This species is the nearest approach we have to the supercilious humming-bird, and indeed it has often been mistaken for it. Nor is this to be wondered at, for it is exactly

of the same form, though of rather smaller dimensions. It differs, however, in some other respects also. The projecting feathers over-stretch the tail for a much less distance. These feathers above are golden green at the base, farther outward they are black, the tips of the lateral feathers are fringed with white, and the projecting narrow parts of the centre plumes are also white. The bill is rather long, the under mandible orange-red verging to brownish at the tip ; the feathers on the upper parts of the body are of a brilliant metallic green, and those on the crown have a reddish border. The ground of the auriculars is black, margined above and underneath by a dull yellow line ; the chin, in form, is like a small gorget, and is of a bright chestnut ; the remaining under parts are deep bluish grey, which, on the centre of the belly and on the vent, in different lights, changes to a reddish yellow ; the lower tail coverts are altogether white. We have no account that can be relied on respecting the native country of this bird.

INTERMEDIATE HUMMING-BIRD (*P. intermedius*). This species is a native of Brazil ; its length is about three inches and a half, and the general colour of its plumage is reddish brown, but on the rump, belly, and vent, it approaches to a senna colour ; the auriculars are black, and under these and above the eye there is a pale yellow stripe ; the centre feathers of the tail do not exceed the others in length more than half an inch ; they taper gradually from the base, the projecting part is pure white, the other parts are black, and the outer one is fringed with reddish brown ; the under mandible of the bill, at its base, is pink, farther out it is black, then pink again, and terminates with a black tip.

BOURCIER'S HUMMING-BIRD (*P. Bourcierii*). This is a Brazilian species, and is supposed to inhabit the mountainous districts. The prevailing tint over the upper parts is reddish green, and it resembles the scaly-backed species in so far as each feather on these parts is bordered with reddish brown ; its tail is of ample dimensions, and the centre feathers are proportionally so ; the upper side is greenish black, deepening in tint towards the tip, where a chestnut spot marks the outer web ; the long feathers are tipped with white, where they exceed the length of the tail, and underneath a brown tinge characterises the whole ; the crown is reddish green, the throat white, and the other under parts reddish grey, most bright on the sides of the neck. In various lights traces of the supercilious streak and that from the rictus are visible in this species.

BROWN BRAZILIAN HUMMING-BIRD (*P. squalidus*). This is also a Brazilian species. From its colouring and general appearance, so closely resembling the supercilious humming-bird, it has been supposed by some to be a climatal variety of that species ; but it does not appear that there is any rational ground for such a conclusion, seeing that it is scarcely one half the size of the supercilious, and that it differs materially from it in other respects. The feathers of the upper parts of the brown Brazilian humming-bird are of a dull brownish green ; those of the throat of a dull grey, with dark centres ; and the covering of the breast is of the same colour, while that of the belly and vent is of a tawny yellow. The tail-feathers are brown, tipped with white, and the centre ones of the same organ, so far as they extend over it, are entirely white. Over the eye is a strongly marked reddish yellow stripe, the auriculars beneath are deep brown,

and the undermost of these is joined with the rictus by another stripe which entirely encircles the eye and ear coverts.

LONGUEMARE'S HUMMING-BIRD (*P. Longuemareus*). This species is a native of Cayenne. It is about three inches eight lines in length. The prevailing colour of the upper parts is brownish red, with brilliant metallic reflections of a green lustre on the back; the feathers on the top of the head, which form a sort of cowl, are dark reddish brown, and the sides of the neck are of the same colour; the under parts are reddish yellow, a shade darker on the throat and breast; the under coverts of the tail are pure white; the tail is wedge shaped, of considerable length, but the centre feathers do not extend nearly so much beyond the others as in some of the species we have just noticed.

RED-BELLIED HUMMING-BIRD (*P. rufigaster*). This pretty little bird is only three inches in length from the tip of the bill to the end of the tail. The bill and tail occupy about two-thirds of the extreme length, so that the body is not more than one inch long; the crown is of a greyish colour, and above a supercilious stripe of white extends to the ear coverts; the upper parts of the back and neck are of a chestnut red, with golden green reflections; the under parts are also of this colour, except that it is of a lighter shade on the throat, and changes to a yellowish white tinge on the chin; the tail is brown, tinged with reddish white; the centre feathers are beautified with golden green reflections, and the extending tips are pure white. It is a native of Brazil.

DAVID'S HUMMING-BIRD (*P. Davidianus*). A figure of this species is given in No. 2 of the plate HUMMING BIRDS. It is nearly of the same size and form as the red-bellied species. The general tint of the plumage is brown, paler, and slightly mottled with yellowish on the under part. The top of the head is furnished with produced feathers, which form a crest of considerable length; the tail is broad and rounded. It is found on the continental part of tropical America, and named by Lessou after David the French painter.

HAIRY-LEGGED HUMMING-BIRD (*P. hirsutus*). The tarsi of this species are not so completely feathered as those of the hairy-legged rocket-tail formerly described; but still they are sufficiently so for entitling the bird to the name by which it is known. It is by no means a rare species, being found in many of the West India islands, and also in Mexico, though it is said not to be very common in the latter country. It is about four inches in length, of which the bill and tail occupy about the half. The bill is regularly but not greatly curved, rather stout at the base, and tapering gradually to the tip; the upper parts are of a shining brownish green with bronze-coloured reflections, except some of the lesser coverts of the wings, which are bluish; the under parts are bright reddish brown; the tail is of a similar colour, but redder; the tips of all the feathers, save the centre ones, are white; and immediately within the white there is a broad black bar.

SWAINSON'S HUMMING-BIRD (*P. Swainsonii*). This species was first described as a Brazilian bird by Swainson; it is about three inches in length, and has the upper part yellowish green, with yellow margins to some of the feathers, and the under part chestnut; the middle feathers of the tail are green, the others yellow with white tips, and within the white there is a bar of black crossing the feathers.

There are several species, or varieties, resembling these in many of their characters, to be met with in museums and collections, almost all of which have been brought from central America, but their history is so well known, that a mere enumeration of their colonies would be waste of time.

SAW-BILLED SPOTTED HUMMING-BIRD (*P. naxosus*). This bird has been found chiefly, if not exclusively, in the mountainous parts of Brazil, near Rios, to which we have already alluded as being the favourite resort of a vast number of this curious species of birds. Its length is about five inches; the whole of the upper parts are olive green, with metallic reflections, which are very brilliant, especially on the shoulders and wing-coverts; the ear-coverts, as well as a tuft of produced feathers which passes down the sides of the neck, are of a bright reddish brown, deeper under the eye, and at the extremities of the auriculars, where it contrasts beautifully in relief with a pale stripe of a similar colour, that extends from the eye; the wings are of great strength, and the shafts are of proportional power; their colour is purplish green; the tail is rounded; the middle feathers, as well as the basal parts of the outer ones, are of a similar colour to the wings; the outer feathers, next the centre, are of a pale yellowish brown at the tips, and in the other feathers, taken outward from the centre, this yellowish portion becomes gradually more extended, which gives a bold relief to the dark spots on the rest of the feathers. The bill of this bird is the most singular part of its structure; it is long, strong, rather broad, straight in the greater part of the length, but curving slightly downwards in the upper mandible, and very slightly upwards in the under one, which is shorter than the other; the portion of the upper one which extends beyond the under, forms a little hook, and both mandibles are, for about one-third of their length from the hook, armed with pretty strong teeth directed backwards, and thus resembling the mandibles of the mergansers, and some other aquatic birds, which seize their prey by a rapid snatch with the bill while they are driving through the water. From this structure of the bill, it is natural to conclude that those birds seize their food on the wing, not by straight-forward flight like the swifts, as the form of the tail does not adapt them for beating the air in the same manner as the swifts do; but as the breadth and power of the tail enable them to ascend and descend with great rapidity, it is probable that they snatch small insects from the flowers and leaves of plants, or even from the ground, without alighting, and their very small and weak feet are proof that they are not in any way ground birds, or capable of using the foot for any other purpose than simply that of perching. It is worthy of remark, too, that in this species, as well as in the others that are decidedly mountainous, we find a breaking or mottling of the colours, which is not found in the species which inhabit the low and warm places. Thus we have, as it were, even in birds which may be said to be chiefly tropical, as well as wholly American, some sort of approximation to the variety of colour which characterises the birds of different climates. On the eastern continent the tropical birds, generally speaking, have their colours entire, and are remarkable either for the beauty of their tints, or the brilliancy of their metallic lustres. The birds of the colder climates again have their colours more broken, more sober in the tints, less brilliant in metallic reflections, and very seldom of that scaly

form which is so characteristic of many of the humming-birds; their feathers, in short, have more the structure of clothing feathers which protect them from the general temperature of the weather, while the tropical plumage which breaks the sun-beams into so many colours by refraction appears to be more a protection against the action of that luminary. From this circumstance, a humming-bird, in all probability, while it scatters the solar light around it in all those radiant lustres that are so much admired, remains unaffected, and able to perform its very arduous and incessant labour, under a degree of fervour which would send the ordinary birds of our country panting to the earth, or compel them to seek the cover of the thick foliage, as most of our birds do in the sultry hours of the summer's day. The humming-birds appear to be possessed of this faculty in a much higher degree than the larger birds which are natives of the same climate, and inhabit the same places; for, as is the case with our birds, these last are driven to the shade during the heat of the day, and the fervid sun-beam is left to the humming-birds, as the genuine children of the sun.

SUB-DIVISION IV. — (*Campylopterus*). Literally "curved wing," but the usual name given to this form of wings is sabre-wing, or sickle-wing, the wing being so much bent as to have some slight resemblance to one or another of these implements. The characters of this sub-division stated in brief are: the wings much bent, with the basal parts of the shafts very much enlarged and compressed; and the tail is rounded, or staged, by having the longest feathers in the middle, and those towards the sides gradually shorter. The bill is rather long, a little bent, and there is sometimes a slight approximation to a tooth, in an angular elevation near the tip of the upper mandible. These wings, from the peculiar form of the shafts of the quills, are stiffer and stronger in proportion to their size than the wings of almost any other birds whatever. The greater number of them frequent damp woods and the margins of streams; and in all probability subsist chiefly upon insect food; and from the nature of the places which they haunt, specimens are rare, and the birds themselves are rarely seen.

BLUE-THROATED SABRE-WING (*C. latipennis*).—The trivial name *latipennis* is not given to this bird on account of the breadth of the webs of the feathers, but on account of that of the shafts; though the wings themselves are very long, and the quills very much bent. Hitherto the specimens have been procured from some of the West-India islands, especially from the island of Tobago; but as that island lies at no great distance from the lower valley of the Orinoco, it is probable that the same birds are also found in that valley. The length is nearly five inches and a half; the bill of moderate length considered as the bill of a humming-bird; the wings long and powerful; and the tail also powerful and of considerable extent, though not much longer than the closed wings. The general colour of the body is golden green, very rich and beautiful on the upper parts, and extending over the lesser coverts of the wings, and the middle feathers of the tail; but in the under part it has more of a yellowish tinge. The common English name is given from the gorget, which is of a beautiful violet blue in the middle part, passing into blackish blue on the sides, but brilliant through its whole extent. It is composed of scale-shaped feathers, and extends from

the gape to the ear-coverts in nearly a straight line upon each side; but the upper part of the ear-covert consists of two or three small green feathers immediately behind and under the eye. It is rounded in the under part, and extends only over the chin and throat. The wings are purplish black; and the centre feathers of the tail, though in some lights of nearly the same green as the back, are almost black in other lights. The next pair are raven black, or black with bluish reflections; and the three exterior ones on each side have white tips for a considerable part of their length. They are not so much day birds as some others of the genus, but make their appearance in greatest numbers in the evenings; and some reports state that they shift their ground with the seasons.

Other species, differing little from this one, excepting in colours, are found in various parts of the West Indies and South America; but they occur only in low-lying places; and though there is a Mexican species, occurring on the table-land of that country, which resembles them in some respects, yet the quills of its wings, though very strong in the shafts, have not the peculiar form of these.

SUB-DIVISION V. (*Lampornis*). The birds of this sub-division have the bill considerably arched; and the tail short, sometimes a little rounded, at other times slightly forked, but never very far from being even.

MANGO HUMMING-BIRD (*L. Mango*). This is one of the most common species in the West-India islands, being found in almost all of them; but owing to the changes of plumage to which it is subject at different ages, it has been multiplied into a number of species. This is the more remarkable that the bird itself is more easily observed than almost any of the others, being hardy and familiar as well as common. When full grown its length is about four inches and a quarter; the back, back of the neck, flanks, and lower tail coverts are brilliant golden green; and the forehead and crown, in different lights, exhibit marked and brilliant reflections of the same colour. A stripe of deep velvet black, shaded into the sides with a very bright steel blue, runs from the chin to the vent. A narrow band of white bars the thighs where they join the flank. The feathers of the tail are broad and rounded at the tips; the upper middle feathers are of a beautiful golden green with reflections of violet; the others on the upper part, as well as the under ones, are also of this tinge, but with a deeper hue according as the various lights fall upon them. In the young birds, the plumage on the upper part is of a paler tint, more inclining to a golden brown, while that on the under part is white, mixed with green on the flanks, and having a line of blackish-brown mottling from the chin to the centre of the belly. With the exception of the upper surface of the two middle feathers, which is of the same colour with the back, the tail feathers are pale, but clear violet; and in the very young state the exterior ones have white tips. It is greatly owing to the number of times that these birds breed in the course of the year, and the consequent appearance of individuals in all the varied stages of plumage at the same instant, that so much confusion has been introduced into the popular descriptions of this species; and this shows how necessary it is that we should attend to all the habits and changes of appearance in every animal, of which our knowledge is to be at all correct, even in one particular.

TOPAZ-THROATED HUMMING-BIRD (*L. Pella*). This is one of the most beautiful of these birds, and it differs from most others of the sub-divisions in having two produced feathers in the tail, having short and silky webs. Its wings are remarkably sharp pointed; and though the tail, with the exception of the produced feathers to which we have alluded, is rounded, yet it appears that the bird can turn on these feathers, and the sharp points of its wings, much in the same manner that a swallow turns. Its habit also corresponds; for, instead of hovering over flowers as is done by most of the humming-birds, this one is described as beating along the surface of the waters, something in the same style as the martens do, and living upon small-winged insects. It is found in the humid and rich parts of tropical America; and nothing can exceed the splendour of its plumage, as it dashes along over the margins of the streams, or perches on the slender twigs which overhang their banks. It is a bird of considerable size, at least as compared with the other humming birds; for it is five inches and a half in length exclusive of the two produced feathers in the tail, which are fully three inches more. It is exceedingly difficult to say what is the colour of the body, for it is all over one colour, and yet in different positions of the light every part of it is all colours. It is entirely composed of scaly feathers, similar in texture to those which we have noticed as forming the gorgets of so many of the genus; and whenever those feathers occur, we are always certain of obtaining a great variety of colours by exposure to different lights. The unrefracted colour of the body is a sort of brown; but the reflections which it gives out vary from the brightest golden yellow to the most intense ruby red, the former being the prevailing lustre in the under part of the bird, and the latter that in the upper part; while between the one and the other there is a continual play along the sides of the flanks, which has the most beautiful effect that can be imagined. The prevailing colour of the gorget is topaz yellow, which becomes emerald green in oblique lights, deepening towards the extremities, until it passes into a margin of velvet black, which again gradually melts into the general colour of the body. The tail is bright chestnut on the under side, and golden green on the upper, with reflections of bright red. The two produced feathers are purplish black, as are also the quills of the wings. The short feathers of the tail are rounded at the extremity, but the bird has considerable power over the two produced ones, so that it sometimes brings them together at the middle as if they were but one feather, and at other times extends them as if the tail were deeply forked. The tarsi are feathered down to the articulation of the toes; and the feet, though small, are stout and well adapted for perching.

The female is smaller than the male, and differently coloured; the plumage in that sex being green with metallic lustre, but subdued by a greyish tinge. The gorget is much less distinct than in the male bird, and its colours vary from brown to golden yellow. The vent feathers also are grey, the outer tail feathers dull green, the next to them violet, and the remaining ones chestnut colour. The young are without the produced feathers in the tail. They have the plumage above of a bright green colour, marked by blotches of ruby reflections; the under part partakes more of red, and the reflections on it vary from green to orange. The brilliant gorget does not appear

until the birds have arrived at maturity. This singularly beautiful species is rendered a little more perplexing by changes of plumage, to which it is subject in different individuals. These are rare; but they do occur in blotches of pale colour; and when this takes place, the remaining tint is different from that of birds, in which there is no breaking of the colour. Altogether, however, it is one of the most beautiful in the whole multitude of the feathered race.

WHITE-COLLARED HUMMING-BIRD (*L. mellivorus*). This species is common in many of the West-India islands, and also in the adjoining parts of the continent of South America. It is fond of low and marshy situations, where it flies low, and has some of the habits of the bee-eaters. The male bird has the forehead, the cheeks, and the ear-coverts, and also the throat, of a very rich blue, the nape and upper part generally golden green, a crescent-shaped spot of pure white on the hind neck, with the points directed toward the eyes, but not reaching them, the space from the gape across the eye being marked by a narrow line of black. The under parts are white, as are also the feathers of the tail, with the exception of the tips, and a narrow portion of the outer margins, and these are black. When the tail is in a state of repose, it is divided into two lobes, curving slightly outwards from each other, and forming a sort of fork, at the extremity of each lobe of which each feather is a little shorter than the one immediately under it, thus showing alternate narrow arches of black and white. When the bird is in action each lobe of the tail expands, but it still retains a slight appearance of being forked. The upper coverts also partake of this forked character, forming two lancet-shaped points of green, which come out very beautifully upon the white feathers under them. In the female the colours are different, the under part being grey; and the green extending to the tips of the middle tail feathers, and over a considerable portion of the basal part of the rest. These last, however, have white tips, and within the white a band of blue separating it from the green. The colours are, however, subject to several variations in the species generally, and more especially in the female; so that they are not so much to be depended on as in many of the other species. The form of the tail is, however, a character which is not easily mistaken.

BLACK-BREASTED HUMMING-BIRD (*L. gramineus*). Buffon and some of the earlier describers have named this as if it were a Mexican species, from which it might be concluded that its general habits differ from those which we have just described, and to which it bears a very close resemblance in its structure. They are birds of humid places, and dryness is the prevailing character of Mexico. The name, however, is a mere mistake of the describers; for the bird is found in the West-India islands and the northern parts of South America, where, like the others of the section, it prefers the low and marshy grounds and the margins of the waters. According to Vieillot, it "delights in the vicinity of inhabited places, which it rarely quits as long as the trees and shrubs continue in bloom; it generally perches on a stray or withered twig, where it expands its tail. I have never heard it sing; but while flying, and especially during the season of incubation, it utters a continued cry, which often betrays it before it would otherwise be discovered. This little bird will seldom allow others to approach the tree on which its nest is built. The

mocking-bird is obliged to yield to his pursuit ; he continually darts around, and striking his bill at the eyes of the intruder, obliges him to fly." This is rather a stoutly made bird ; and though it is not so brilliant as some of the others, it is still a beautiful bird, and one of compact and graceful form, and very powerful wing. There are considerable differences between the plumage of the young and the mature birds ; and as the progress from the one to the other is gradual, the young show considerable differences from each other. In the full-grown male, the upper part is golden green ; and the gorget on the throat and fore neck fine emerald green, and composed of very handsome scale-shaped feathers, which are very changeable in different lights, and even black, when no portion of refracted light from them reaches the eye. Immediately under the gorget there is a patch of dull purplish black on the breast, gradually passing into the green colour of the upper part, and backwards, and on the flanks passes into brown, while the vent feathers are white. The tail is large and strong, rounded at the extremity, and black at the tip ; but the feathers are purplish brown for more than two-thirds of their length. In the young, the upper part of the body is golden green, as in the mature birds ; but the green gorget on the neck is wanting ; and the whole of that part, as well as the middle of the under part generally, is dull black. This black is more or less broken at the sides, as is also the green on the upper part, and the space between is of a dull whitish colour, with blotches of red brown and green blended together. The middle tail feathers at this age are deep oil-green, and the remaining ones, with the exception of a white spot on the extremity of each, are very like the same feathers on the mature bird.

GREEN HUMMING-BIRD (*L. viridis*). This species occurs in some of the West-India islands. It is not so striking in its plumage, but still it is a very pretty little bird. The whole colour of the plumage is an emerald green, with very little metallic reflections except on the upper tail coverts. The tail is bluish black, with a narrow white margin on the outside of each of the exterior feathers. It is rather a rare species, and few specimens have been brought to Europe.

BUFFON'S HUMMING-BIRD (*L. Buffonii*). This is a handsome species, though very little is known respecting it, not even what country it inhabits ; but it is supposed to be Brazil. That country, however, becomes a sort of Siberia to all humming-birds of which the localities are imperfectly known ; for just as it has been the custom with the describers of migrant birds of the eastern continent to send to Siberia every bird for which they could find no resting place, so it has been very much the custom with those who have attempted to describe the appearances and localities of humming birds, to refer to Brazil every one of whose native country they were ignorant. This bird has the whole clothing feathers, with the exception of those on the vent, between the shoulders, and in the middle of the belly, of the scaly character. The general colour is golden green, passing into brownish green in some parts, and into emerald green in others, while on the under part the tint is more inclined to blue ; and the edges of the feathers are relieved by greyish margins. The under covert of the tail and vent feathers are white, the tail feathers themselves are blackish blue, and the quills are purplish black. The bird is stoutly made, and between five and six

inches in length ; and altogether of a more robust appearance than very many of the genus.

PURPLE HUMMING-BIRD (*L. Caligna*). In its size and form this species bears a considerable resemblance to the last-mentioned ; but the form of the bill is different, being almost entirely straight, while that of the others is slightly bent. The only specimens which have been examined are understood to have been natives of Mexico, or at all events to have been procured from that country. They have, however, been few in number, and the bird is consequently very rare ; because if it were even moderately abundant, its beauty, and the peculiar tint of its plumage, in which it differs from every other known species, would make it sought after with avidity. Rare as it is, however, there is no good reason for supposing that the specimens which have been obtained are coloured varieties of any other better known species, for the general air and character of the bird are as distinct as the tints of its colour. The general plumage is purple, varying on the upper part from pure violet to a very intense and brilliant red, according to the light in which it is seen ; and subdued on the under part with a mixture of a very delicate grey, which is really more beautiful than many of the colours that are gayer and more decided in the tint. The colour on the upper part passes from the purple gradually to golden green on the lower part of the back, the rump, and the upper coverts of the tail, with the exception of the last coverts, on which again the purple is predominant. All the feathers on the upper part, from the base of the bill to the tail coverts, are of the scaly character ; and they increase in size toward the tail. They have metallic reflections of rich lustre throughout the whole extent, but those reflections rather increase in brilliance as the feathers become larger ; and some of those toward the hinder part show golden yellow and golden green on the margins, and purple on the centre ; the gorget is formed of delicate grey feathers, darker in the centre ; the colour of the whole under part is particularly soft and pleasant, and passes nearly into white on the vent feathers ; the tail feathers are strong and broad, and shortest in the middle, making a slight fork, or rather two lobes with curved extremities ; they are of the same purplish colour as the upper part, and so also are the quills of the wings, but they are without the brilliant reflections ; the larger coverts of the wings are of the same purple mixed with green, and the green increases in those which are nearest the body. Altogether, however, there is much less green in this bird than in almost any other of the family.

BLACK HUMMING-BIRD (*L. niger*). is another species, remarkable for the peculiarity of its colour. The prevailing tint is deep black, dashed with a tinge of blue on the head, and of green on the upper part of the back, and the scapulars. The vent and tail feathers are white, but the latter have a band of black across the tips. The female has the general colour much less intense, and inclining to brown ; and the tail is black, with the exception of the outer web of each of the exterior feathers. This is a Brazilian species, but it is not very common.

There are various other species of this, as well as of the other sub-divisions, which are met with in extensive collections of these singular birds ; and there is no doubt that in proportion as the tropical parts of America are more explored—and the exploring of them has now become practicable, and is for other

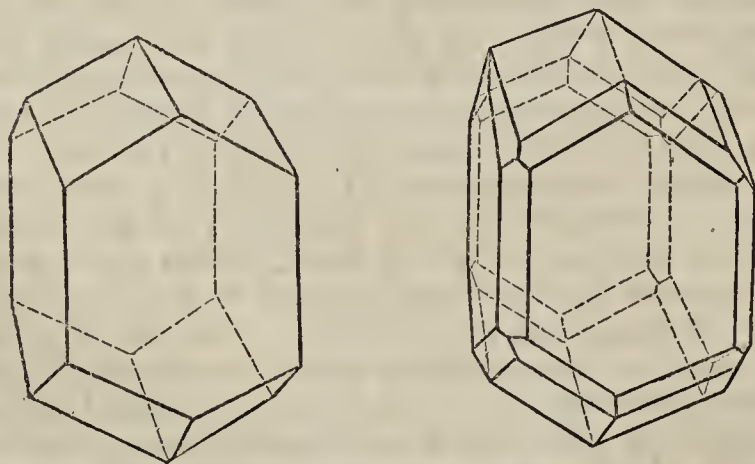
reasons desirable—many more will be added to the lists, and something known of their manners beyond what we understand at present, which, it must be supposed, lies within a very small compass. The account which we have given is little else than a mere catalogue; and we have not been able to say much of their relations to the rest of nature, but it is all that our limits will afford.

HUMULUS. A genus of plants belonging to the natural order *Urticeæ*, of which the hop, *H. lupulus*, is a well known example. This climbing perennial is a native of Britain, and is very extensively cultivated in several counties: the flowers which appear in July are furnished with scales, are whitish, grow in panicles, having a five-leaved calyx, and no corolla; the female flowers have a one-leaved entire spreading calyx, and no corolla. The fruit cones are egg-shaped and pendulous; these cones, after being dried in a kiln, are used extensively in the manufacture of beer and porter.

HYACINTH (Linnæus). A beautiful and much esteemed bulbous bed-flower, belonging to the sixth class of Linnæus, and natural order *Asphodeleæ*. This genus has been long celebrated, not only for the beautiful fable whence its name has been fancifully derived, but also for the immense number of varieties which culture has produced. Of the *H. orientalis*, the common species, the Haarlem florists had at one time upwards of two thousand varieties. These bulbs, as well as those of the tulip and narcissus, once formed a most valuable, and still a not important, branch of Dutch commerce.

HYACINTH. This beautiful mineral was well known to the ancients, who applied the same name to the common zircon, when it partook of the hyacinth-red colour. It occasionally occurs in angular grains, but is more frequently crystallised, of which two examples are given in the annexed diagrams.

Hyacinth may readily be distinguished from the garnet by its crystallisation, resinous lustre, distinct cleavage, and great weight. It occurs in every quarter of the globe, but some of the finest specimens have been brought from the Island of Ceylon. This stone readily loses its colour when exposed to the action of heat, and, in consequence of its great brilliancy, it is frequently substituted for the diamond,



Hyacinth.

the colour being first destroyed by the action of the blowpipe. It is, however, rarely found of a large size. Small crystals of quartz, tinged with iron, are found in Spain, and have been termed "Hyacinths of Compostella."

HYÆNA (*Hyæna*). A genus of carnivorous mammalia, with plantigrade feet, and, with the exception of the cat tribe, having the mouth of a more carnivo-

rous structure than any of the order. The characters are, six incisors and two canine teeth in each jaw, both very strong; five cheek teeth in each side of the upper jaw, and four in each side of the under. In the upper jaw there is one very large three-lobed carnivorous tooth, with a small tuberculated tooth behind it. The carnivorous tooth in the lower jaw has two points, and the tuberculous tooth is wanting behind it. The jaws, in order to give a proper base to those formidable teeth, are large and powerful; shorter than those of the dogs, but longer than those of the cats. The tongue is covered with horny points, and not smooth as in the dog; but those points do not form so decided hooks as are met with in the lion, and the other larger and more powerful cats. The hyænas have only four toes on the feet, the thumb on the fore foot being merely a little bone concealed under the skin. The claws upon the toes are strong; but they are not retractile, neither have they sharp points nor tearing edges, like the claws of cats; they are rather adapted for burrowing in the ground.

The general aspect of the hyæna more resembles that of the dog than of any other race, and there appears to be no inconsiderable correspondence in the manners of the two; still, however, there are sufficient distinctions between them for making the hyænas a separate genus, and even a division of the beasts of prey. Hyænas are now chiefly confined to Africa and the south of Asia, so that they are found in those places of the eastern continent where we find the remains of various other races which have in former times been more generally distributed, and which, therefore, bespeak a very different condition of the countries where their bones are found than obtains at the present day. In Britain, and generally throughout Europe, we find, in half filled caves and other singular sepulchres, which have been formed by the hand of nature, the bones of hyænas among others, and that in no single or solitary specimens, but literally in heaps, as if, at some period of history, they had been among the most common inhabitants of the place. They are all wild animals, at least they have not been generally domesticated, though it is understood that, in various parts of India the people keep them in their houses as dogs; and it has been pretty well ascertained that, if treated with kindness, they not only show no ferocity, but conduct themselves with mildness, and remember for a long time the civil treatment they meet with. The common notion of their untameableness is therefore quite unfounded, and so is the yet more ridiculous story of their being double sexed animals. They are not even to be considered as among the most murderous of the carnivora, for they have more the character of gnawing than of killing animals. From the structure of their bodies they are not very fleet, and their claws can be of but little assistance to them in seizing living prey, however serviceable they may be in enabling them to burrow in the earth. They come under the class of scavengers, or feeders upon carrion; and they prowl about, entering the villages, and digging into sepulchres. Their appetite is very ravenous; and after they have eaten the flesh of those animals on which they prey, and cleaned the bones with their rough tongues, they set about gnawing them, and perform the task with more perseverance and success than almost any other animals. There are several species, some of which however have not been very clearly made out.

STRIPED HYÆNA (*H. vulgaris*) is the species which has been longest known, and the one of which so many ridiculous stories have been told. One point of ancient belief was, that its neck was composed of a single bone without any joints; which is not true, though the neck is certainly stiffer than that of most animals; this stiffness is evidently for the purpose of getting a powerful point of support for its formidable jaws. Another of the ancient fables was, that it possessed a sort of power of incantation, by means of which it could hold shepherds, shepherdesses, and others, who had occasion to be in the woods and wilds, riveted to the spot, so that they were unable to escape from it. This may have arisen from the glaring appearance which the eyes of this animal have in the dark, and which is simply characteristic of its nocturnal habits. But the most ridiculous of all those fabulous accounts was the annual changing of its sex, so that it was a male the one year, and a female the other.

This species, when full grown, is about the size of a large dog or wolf, but shaggy and ragged in its appearance. The hair is of a rough wiry texture; and along the dorsal line, from the head to the insertion of the tail, there runs a coarse bristly mane, which gives a peculiar character to the back of the animal, to which there is scarcely any thing corresponding among other beasts of prey. The tail is short and bushy, sometimes plain, and sometimes fringed with black. Under the tail there is an orifice, which communicates with a sort of sac or pouch, containing a substance resembling civet, but much more offensive to the smell. The head is broad and flat; the eyes are large, and exhibit a peculiar expression of wildness and sullen ferocity. The ground colour of the body is generally of a clear fawn, but there are many varieties of shade in the species. Some are of a deep brown tint, and others brownish grey; and they are invariably brindled or striped with darker shades. The snout is black and remarkably full; the legs are very strong, and altogether the animal is very formidable in proportion to its size. In the carriage of its head it resembles a dog on the scent; and when dislodged from cover, and obliged to retreat, it limps off at first, seemingly lurch-backed and lame; but when it has measured a short distance, these apparent impediments wear off, and it steps out at a rapid rate.

The striped hyæna is a wild and solitary animal, and chooses for its habitation the most hidden dens and caverns of the earth; and, when nature fails to provide it with a dwelling-place in its favourite locality, it sets to work and excavates a hole in the cleft of a rock, or some other mountainous recess, for its own accommodation. The cry it utters is very peculiar. It commences with a low moaning sound, not unlike that of a human being under the influence of pain, and gradually rises into the most loud and violent bellowing. It generally conceals itself during the day time, and comes forth in the night in quest of its prey. In their roaming for this end, hyænas are peculiarly assiduous and daring, and do not turn aside from obstacles that would be accounted insurmountable by much larger animals. When put to it they will not shrink from an encounter with the panther, or even the lion himself, and they frequently attack and vanquish the ounce and other animals much larger than itself. In their nocturnal prowlings, when excited by hunger, they do not hesitate to

visit the habitations of man; and the enclosures round these do not always prove a sufficient protection from their savage attacks on such domestic animals as they mark out for their victims. Nor does the sight of man, or the report of fire-arms, scare them from their prey. The most revolting of all the characteristics in the economy of the hyæna, is its sacrilegious violations of the repositories of the dead; and what is scarcely less so, is its blood-thirsty propensity of following armies, and of feasting on the remains of those who may be slain in battle. Though, generally speaking, unsocial animals, hyænas have been known to unite in considerable numbers on occasions, such as the watching and dogging of the movements of contending armies, attacking flocks and herds, or when the live stock of the village is marked out for plunder.

SPOTTED HYÆNA (*H. crocuta*) inhabits southern Africa, and is to be met with in large numbers at the Cape of Good Hope. It is generally termed the Cape Hyæna, but the colonists give it the name of the Tiger-Wolf. It is considerably smaller than the striped species, and the bristly mane does not extend beyond the loins, betwixt which and the tail a few scattered, produced hairs only are observable. Its general tint, on the upper part of the body, is dull yellow, and the belly and limbs are blackish brown. A deeper tinge of this last spots almost every part of the body. The character and habits of this species, in point of ferocity, do not differ materially from the striped hyæna, except, perhaps, that they are even more daring when pressed by hunger, and more easily reduced to a state of domestication. Its feelings, both of hatred and affection, seem to be equally strong. Instances are recorded of individuals manifesting the strongest affection and regard for their keepers; whilst, on the other hand, they would exhibit the most violent rage against persons who had given them no cause of offence. Barrow relates that the spotted hyæna is met with in a domesticated state in the district of Schneuberg, where it is found equal in point of intelligence and fidelity to the dog, and even more serviceable in the chase than that animal. In the wild state they have been known to enter the huts of hottentots and carry off children, when they were left unprotected; and Thunberg tells us, that such is their temerity, that they will eat the shoes from off the feet, and the saddle from under the head of the traveller, who happens to make his couch in the open air.

VILLOSA HYÆNA (*H. villosa*). This species or variety, for it is not yet settled whether it is the one or the other, is a native of southern Africa. The first account we have of it is by Dr. Andrew Smith, Superintendent of the South African Museum. It is understood that the villose hyæna is smaller in size than the striped variety; it is also lighter in the colour, and the hair is longer. We must, however, have additional information, ere we can say much about their habits or economy.

Although, as we have seen, when excited by hunger, they do not hesitate to attack and devour every living animal that they can possibly master, yet their chief and most natural food seems to be animal remains; and in finding out dead carcasses their sense of smell is peculiarly serviceable to them. So much so, indeed, that when an animal happens to fall in their vicinity, either by the hand of the sportsman, the butcher, or other accident, the hyænas are invariably sure to scent it out, and to be on the spot

in a very brief space, claiming their share of the carcass.

HYALŒA (Lamarck; *ANOMIA TRIDINTATA*, Linnæus). This very extraordinary mollusc is of a thin transparent horn-like substance, differing in that respect from the common character of shells as they are generally understood. Its form is tricuspidated, with hollow points, and finely striated transversely. The valves are united, or, as it may familiarly be termed, soldered together. They are unequal; one being sub-globular, ventricose, and anteriorly shortened, occasioning an aperture through which the animal protrudes the two wing-shaped portions of its body; the other is larger, and has its under part nearly flat. It has been fancifully called the Chariot of Venus, from some resemblance it bears to the form of a triumphal car in miniature; and it has been asserted that these molluscs have been seen sailing before the breeze in little fleets; that fact does not, however, rest upon corroborating evidence, though the substance of these molluscs render them peculiarly fitted for such an exhibition, should it be hereafter ascertained, by more frequent observation, that such is the animal's habit of locomotion. Five or six species have been described, all of them inhabiting the warm latitudes; and the genus *Glandiolus*, of D. Montfort, is nearly allied to it in its general characteristics.

HYDATICUS (Leach). A genus of coleopterous insects, belonging to the family of the predaceous water-beetles (*Dyticidæ*), of a moderate size, having the anterior tarsi dilated into a rounded patelliform plate, the elytra smooth in both sexes, and the third and fourth joints of the maxillary palpi of nearly equal length. There are four British species, all of which are of rare occurrence, the type being the *Dyt. transversalis*, Fabricius. In their habits they do not differ from the larger *Dyticidæ*.

HYDRÆNA (Kugellan). A curious genus of minute coleopterous insects, belonging to the *Rypophagous* water-beetles, and family *Helophoridae*, having the maxillary palpi three times as long as the antennæ, by which character they are distinguished from the remainder of the family. The species are found at the roots of grass growing upon the margins of standing water and streams. Their legs are not formed for swimming, and they creep but slowly. Mr. George Waterhouse has lately published a valuable monograph upon this genus in the Entomological Magazine.

HYDRANGÆA (Linnæus). A genus of deciduous shrubs from North America, but the greatest favourite of the genus is the *H. hortensis*, introduced into our gardens from China about 1788. They belong to the tenth class of Linnæus, and to the natural order *Saxifragæ*. One of the peculiarities of the Chinese hydrangæa is its change of colour of the flowers. In common soil they are pink; but, if kept for a season or two in peat earth, they become blue.

HYDROCAMPÆ (Latreille). A genus of Lepidopterous insects, belonging to the section *Nocturnæ* or moths, and family *Pyrælidæ*. See **PYRALIDÆ**.

HYDROCHARIDÆ. A small natural order of aquatic plants, which takes its name from a British herb, frequent in our pools and ditches, called frog-bite (*Hydrocharis*). The other genera, which form the order, are the water-soldier, *Stratiotes*, with the interesting *Vallisneria* and *Damasonium*.

HYDROCORISÆ (Latreille). A primary sec-

tion of hemipterous insects, comprising two families, *Nepidæ* and *Notonectidæ*, which see.

HYDROLEACEÆ. A natural order of plants, containing a single genus only, of which there are two species. They are little elegant plants with blue flowers, chiefly distinguished from *Convolvulacæ* and *Polemoniaceæ*, in the flowers having two styles, as well as in the two-valved capsules. The leaves are alternate and simple, entire or lobed, and without stipules.

HYDROMETRIDÆ (Leach). A family of hemipterous insects, belonging to the section *Heteroptera* and sub-section *Geocorisæ*, and affording an instance of the great difficulty attending the natural classification of groups in natural history. From the structure of the antennæ and proboscis, these insects are united with the land-bugs; but in their habits and the structure of their legs, formed for aquatic life, they are more properly *Hydrocorisæ*, from which, however, they differ in residing upon the surface, and not in the water. For this purpose it is necessary that they should be defended against the action of the waves in the most complete manner, and which we find effected in a two-fold manner. In the typical genus, *Hydrometra*, the legs are simply formed for walking, but the insect is considerably elevated by them above the surface, and is enabled easily in this manner to make its way through grass and the stems of plants growing at the edges of ponds, &c., which is its proper locality; whereas the other genera (*Gerris*, *Velia*) rest their bodies upon the surface of the water, but they are defended from its action by a coating of silky hair, over which the water glides without affecting the body of the insect—these, moreover, are provided with long rowing legs, which enable them to skim rapidly along the surface of the water. The genus *Hydrometra* is extremely slender, and the head is produced into a long narrow muzzle. The type is the *Hydrometra stagnorum*, which is of an opaque, black colour, and more than half an inch in length. For the characters, &c., of *GERRIS*, see the article upon that genus.

HYDROMYS. A genus of rodent mammalia, hitherto found only in the southern part of Australia, and we believe in Van Diemen's Land. See **MOUSE**.

HYDROPELTIDÆ. A natural order of plants, comprising a single genus, of which there is only one species described; but of the properties there is nothing certain known. *Hydropeltis* is an aquatic, and intimately connected with *Caltha*; and a kindred genus, called *Cabomba*, bears a great similitude to the *Batrachia*, even in the heteromorphosis foliage; the floating leaves being lobed, while the immersed ones are very much divided. De Candolle mentions their affinity to the *Nymphæacæ*, with which they are associated by Bartling.

HYDROPHILIDÆ (Leach). A family of coleopterous insects, belonging to the section *Pentamera*, and division *Rypophaga* of Stephens (*Philhydrida*, Mac Leay), comprising such species of water-beetles as have the antennæ short and clubbed at the extremity, and the palpi long and slender; the mandibles are bidentate at the tips, the body is oval and convex, and the hind legs often ciliated. Like the *Dyticidæ*, which also inhabit the water, these insects exhibit but little variation in their colours, which are ordinarily obscure. Their motions in the water are much less active than those of the *Dyticidæ*, the legs not being moved simultaneously. This want of agility is dependant in a great measure

upon the nature of their food, which consists of vegetable matter, although it has been stated that they will also feed upon small aquatic mollusca and insects; but this observation was made by M. Miger upon insects in a state of captivity. M. Esper has made another observation, which shews the weakness of these insects when compared with the other water-beetles. He had confined an individual of the largest species of this family, *Hydrous piceus*, in a glass of water with a *Dyticus marginalis*, not more than half of its size the former, nevertheless, fell an easy prey to the latter; which, having detected a vulnerable part between the head and thorax, greedily devoured it. Unlike the *Dyticidæ*, these insects exhibit a great degree of care for the preservation of their race, in the manner in which they deposit their eggs; which, instead of being laid at random in the water, are united into a mass, and enclosed in a silken cover, in which they are carried about by the female beneath her body until she is able to meet with a convenient spot for their reception, and which is ordinarily the stem of some aquatic plant upon which she attaches her mass of eggs above the surface of the water, whereby they are defended from the attacks of her enemies: in this situation the eggs hatch, and the young larvæ fall into the water. Such is the mode adopted by the smaller species; but the larger ones (*Hyd. piceus*, &c.) differ somewhat. Like the former they are provided with spinnerets at the extremity of the body, and they spin a bag of pure white silk, of a very large size, having on one side an elevated twig or branch, in which the eggs, to the number of fifty or sixty, are enclosed in an upright position, and it is not until they have been hatched several hours, that the young larvæ make their escape. It appears, moreover, from the recently published researches of Lyonnet, that the female also employs in the construction of her nest the fibres of aquatic plants. This, however, is contrary to the remarks of M. Miger, who informs us that the use of the elevated branch of the nest, and which is raised above the surface of the water, as it floats about, is of service in conveying air into the mass of eggs enclosed in the nest. The larvæ are large fleshy grubs, furnished with six legs, which, as well as the head, are of a scaly nature; the former being of a curious form, nearly flat above, and rounded below, which gives it the appearance of being turned upside down. They respire by the assistance of two slender appendages at the extremity of the body. When arrived at its full size, the larva quits the water, and burrows into the soft adjacent earth, where it forms a cell, having the inside smoothened, and in which it becomes a pupa, not exceeding one-half of its previous length; the larva of *H. piceus* being three inches long, and the pupa only one and a half. The abdominal segments of the pupa are furnished with long lateral filaments or soft spines; its thorax is also armed with three curved spines on each side. By these, and by the appendages at the extremity of the body, the pupa is stated to be raised from the surface of the cell, whereby it is prevented from being in constant contact with the damp earth. On arriving at the perfect state, the insect again seeks the water, in which it constantly resides, but it is necessary that it should come from time to time to the surface to obtain a supply of fresh air. Authors had remarked that at such times, unlike the *Dyticidæ*, which respire by the extremity of the body, it protruded its antennæ out of the water, and that they

were applied against the body when it retired again below the surface: but the recent observations of M. Audouin have shewn, that it was by this motion that a bubble of air is carried along the under side of the thorax until it arrives at the abdominal spiracles. The majority of these insects are of small size, but the family comprises a few species, which are amongst the largest of the aquatic coleoptera. The genera are, *Hydrophilus*, *Hydrous*, *Philhydrus*, *Tropisternus*, *Sternolophus*, *Hydrobius*, *Volvulus*, *Berosus*, and *Limnebius*; to which Mr. Stephens adds *Spercheus*. In the typical genus, *Hydrophilus*, the sternum is spined, the pectoral carina being bifid, and the antennæ are obtuse at the tips. The type is the *Hydr. Caraboides*, Linnæus, a very common species, found in the stagnant ponds and ditches, being about three-quarters of an inch in length, and of a shining black colour.

HYDROPHYLLEÆ. A natural order of elegant herbaceous plants, natives of North America. The order contains five genera, viz. *Hydrophyllum*, *Phacelia*, *Entoca*, *Varronia*, *Nemophila*, and *Ellisia*. These associated genera very closely resemble the *Boraginidæ* and *Heliotropidæ*: the twin-celled basal nectary, and one-celled ovary, will, however, sufficiently distinguish them. The fungous-stalked *Placentæ* is also a very peculiar and characteristic structure.

HYDROUS, (Linnæus). A genus of pentamerous coleopterous insects, belonging to the family *Hydrophilidæ*, and differing from *Hydrophilus*, in having the antennæ acute at the tips, the pectoral carina of the prosternum simple, and the terminal joint of the male tarsi, which is dilated into a large triangular plate. The type, *H. piceus*, is the largest of our British water-beetles, being an inch and a half long, of an olive black and shining colour. It is found in ponds and stagnant waters, but not very commonly.

HYDRUS (*Hydra*). A genus or rather family of serpents, which are all inhabitants of the seas or rivers of warm countries. The name was originally applied allegorically to a monster which Hercules is fabled to have subdued; and though Linnæus transferred the name to one of the simplest of all animals, an inhabitant of the fresh waters which can be multiplied by dividing the body into segments, those who treat of the natural history of serpents very generally apply it as the distinctive name of water-serpents, whether these happen to be poisonous or not. They are found in greatest abundance in the seas and rivers of the south-east of Asia, of Australia, and of some of the adjoining countries. In their teeth they resemble the *Colubres* and *Acrochordi*, but they have generally a smaller number of teeth in the external range; and some have the first of this row on each side much larger than the others, and perforated for the purpose of conveying their poison, which is of a very deadly nature in some of the species, into the wound inflicted by the tooth. They live generally under the water; and in this they are distinguished from some other species which are often found swimming on the surface, but which seldom or never dive to the bottom, as the true hydras are in the habit of doing. They feed almost exclusively upon fish. Some of them grow to a very large size; and many, indeed the greater part, are remarkable for the brilliancy of their colours and the elegance of their markings. Cuvier divides them into three subgenera:—

Hydrophis, which chiefly infest the seas, rivers, and other waters of Bengal and the adjoining countries

They usually remain quiet at the bottom, or buried in the sand, during the day; but at night they come to the banks, and attack land animals, and even human beings when they resort to the waters for the purpose of bathing, washing, and cooling themselves. Their characters are: a row of scales along the belly, larger than those on the rest of the body; the head small, obtuse, and furnished with large plates. There are many species of them, some poisonous and others not; but the whole of them are to be regarded with suspicion. The body is compressed in the posterior part, and well adapted for making way through the water.

Pelamis. These have the head covered with large plates as in the former subgenus; but they differ from it in having the occiput tumified in consequence of the length of the pedicles of the lower jaw, which allow a very large opening to the mouth, something in the manner of the pythons, boas, and other large serpents which kill their prey by crushing it. All the scales on the body are nearly equal in size, and they are arranged like a sort of pavement. The greater number of them are found in the tropical and southern Pacific, in many parts of which they are very abundant, and grow to a large size. The natives of some of the islands in that sea eat their flesh when they can capture them.

Chersydrus have the scales upon the head and body nearly of the same size, without any large plates upon the head. They are chiefly found in the seas and rivers of Java, where some of them are possessed of very deadly poison. By some writers they have been confounded with serpents which are perfectly harmless, as well as singular; and those mistakes are the more to be regretted, when a perfectly harmless animal is confounded with one whose powers of doing mischief are very great. Thus *Aular cærrau* of the Javise, *Aerochordus Javanensis*, or warty serpent, is not only not poisonous, but a vegetable feeder; while the *Aular limpe*, which is the banded *Aerochordus* of some authors, is perhaps the most poisonous serpent that inhabits the water. The history of the whole race is imperfect however; and, from the difficulty of obtaining information, it is not easily rectified.

HYLÆUS (Fabricius). A genus of short-tongued bees (**ANDRENIDÆ**), which see for its characters.

HYLOBIUS (Germar). A very destructive genus of coleopterous insects belonging to the section *Tetramera* and family *Cureulionidæ*, having the antennæ twelve-jointed, the rostrum moderately long, somewhat rounded with a lateral impression extending from the middle of the eyes; the elytra, which are not united together, are of an oblong-ovate form, and the body is furnished with wings; the legs are moderately short and thick, and the femora are armed with a spine. There are several species, one only of which has fortunately occurred in any abundance in this country. This is the *Cureulio abietis*, Linnæus, a species varying from five to nine lines in length, of a pitchy black colour, with numerous yellow spots on the elytra. This insect has rarely occurred in England, but in Scotland it has been found in great quantities in the fir plantations, in which it makes great devastation, as appears from a letter from J. Loch, Esq., agent for the estates of the Marquis of Stafford and Earl of Carlisle, dated August 29, 1824, and addressed to Mr. W. S. MacLeay, by whom it was published in the fourth number of the *Zoological Journal*:—"There has been lately a great failure of the young firs and larches on Lord

Carlisle's estates here. It was at first thought to be occasioned by mice, so completely was the bark destroyed. The wood-warden is now, however, persuaded that the mischief is done by the insects inclosed in the box sent along with this. The destruction is more rapid where the roots of the Scotch fir are in a state of decay." Mr. MacLeay then proceeds—"This last remark indeed goes of itself far to prove that the author of the mischief is an insect, for mice would only attack the green and healthy bark; and to set the question at rest, the insect of which many specimens were sent, proved to be no other than the *Hylobius abietis* of Germar (*Cureulio pini* of the *Entomologia Britannica*), an insect most destructive to firs. It is very common in the pine forests of Sweden and Scotland, but in England I believe it has only as yet been found in Cumberland and Shropshire." Mr. MacLeay then gives the synonymy of the insect, which Linnæus named *Cureulio pini* as well as *C. abietis*, observing that it inhabits the *Pinus sylvestris*, and devours its resin; and then, in his peculiar style, he proceeds to describe its manners as follows:—"Tarde incedit, arcte apprehendit, tenaciter adhæret, ore frustra cutem mordere tentat captivus." Beyond these observations little is known of the economy of this destructive insect, and it is therefore impossible to point out a remedy for the evil until we have more detailed accounts of the method in which the trees are attacked. The naturalists in the north might, however, easily acquire some insight into the history of the insect, by examining the fir trees in Rivelston Wood, near Edinburgh, where it was first discovered during the winter season, and watching the larvæ until they make their appearance as perfect insects.

HYLURGUS (Latreille). A genus of coleopterous insects belonging to the section *Tetramera*, and family *Scolytidæ* (or **BOSTRICHIDÆ**, which see), having the elytra rounded at the tips, the thorax not hooded, the club of the antennæ sub-globose, and the body cylindrical. These are small beetles of very destructive habits, the type of which (*Dermestes piniperdus*, Linnæus) is figured in our first volume, p. 570, col. 2, where fig. 3 represents the insect of the natural size, fig. 4 ditto magnified, fig. 5 the larva or maggot, and fig. 6 the pupa (the figures 1 and 2, of which the names were accidentally omitted, represent the typographer beetle of the natural size and magnified, of whose proceedings an account is given in the preceding page). The pine *Hylurgus* is extremely injurious to young pines, by destroying the leading shoots. The following observations respecting it were made by Professor Lindley, and communicated to Mr. Curtis, with drawings of the sections of the stems shewing the course of the tracks of the beetle:—"For the purpose of examining its proceedings more narrowly, I placed a shoot of the Scotch fir under a glass with the insect. In about three hours after, it had just begun to pierce the bark at the base of one of the leaves; its mandibles seemed chiefly employed, its legs being merely used as a means of fixing itself more firmly. Four hours after, its head and thorax were completely buried in the shoot, and it had thrown out a quantity of wood which it had reduced to a powder, and which nearly covered the bottom of the glass. In sixteen hours more it was entirely concealed, and was beginning to form its perpendicular excavation, and was busily employed in throwing back the wood as it proceeded in destroying it; there were evidently two kinds of this saw-dust, part consisting

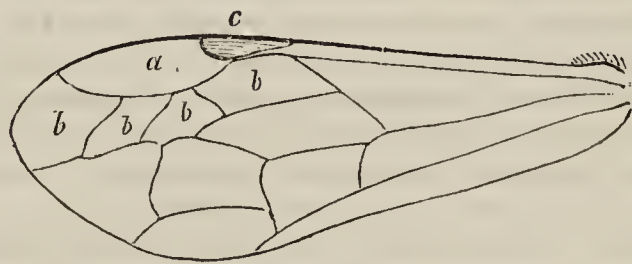
of shapeless lumps, but the greater portion of very thin semi-transparent lamellæ, or rather shavings. I now examined it every day till the fifth, when I found it had emerged through the central buds at about an inch from where it had first commenced." This species is about one-sixth of an inch long, of a black colour, with the elytra finely punctured in lines; it varies to a pale dirty buff or red colour, probably owing to immaturity. There are numerous other species of this genus, eight being inhabitants of this country.

HYMENŒA (Linnæus). A genus of plants, called from its having united leaves. They are the locust trees of English travellers, and found in tropical America and Madagascar. The flowers are decandrous, and of course belong to the natural order *Leguminosæ*. The pods of *H. courbaril* contain a soft filamentose substance as sweet as honey, and having an aromatic flavour something resembling gingerbread. The Indians are extremely fond of the fruit, and the monkeys, as well as the children, devour it with avidity. The gum known in commerce as *gum animi* is extracted from several of the species. The heartwood of the courbaril is very hard and tough, and is hence much valued for wheel work, particularly for cogs. It will take a fine polish, and is so heavy that a cubic foot weighs about one hundred pounds. It is called "mountain ebony." In our stove collections the plants are grown in loam and moor-earth, and increased by cuttings.

HYMENOPTERA. An order of insects belonging to the great division *Mandibulata*, or those furnished with lateral jaws, and distinguished by having four membranous wings, furnished with various veins, forming cells, but not assuming the appearance of net work, the posterior pair being smaller than the anterior; the mouth composed of a pair of upper and lower jaws, and two lips, the lower of which is elongated, and forms, together with the lower jaws, a kind of tongue or sucker, capable of being extended to a considerable length, and employed in collecting honey from flowers; the females are furnished with a horny apparatus, at the extremity of the body, which in some species is transformed into a pair of saws, adapted for making slits in twigs of plants, for the reception of the eggs, and in the others consisting of a powerful sting, the structure of which we have already described in our article upon the bee. In others again, it is elongated into an ovipositor, adapted for depositing the eggs in the bodies of caterpillars, &c. The head is furnished, moreover, with a pair of antennæ, which in the typical division, consist of thirteen joints in the males, and twelve in the females; in the rest the number of the joints varies in the greatest degree, in some consisting of only five or six, and in others of sixty or seventy articulations. In the form of these organs we also find great variation, the sexes differing in this respect, in some being long and slender, in others short and clubbed; in some furnished with hairs, in others branched or forked, and in the majority elbowed at the extremity of the basal joint, which is ordinarily long. The eyes are large, and occupy the sides of the head; they are alike in both sexes, except in a very few instances, in which they are united in the males on the crown of the head, as in some of the diptera; they are generally round or oval, whilst in some, as the wasps, they are kidney shaped. They are asserted to be obsolete in a few species of ants.

In addition to these composite eyes, the majority of the insects of this order are furnished with three minute simple eyelets (ocelli), on the crown of the head; the lower jaw and lip are furnished with palpi, which vary in the number of their joints from six to one.

The thoracic segments are united into an oval mass, in the front of which is to be observed an arched piece, termed the collar; and at the sides are attached the two pairs of wings, the anterior pair having a seale (squamula) at the base. The front margin of the anterior wings is furnished, a little beyond the centre, with a callous point, termed the stigma, *c*, from which is emitted a vein or nerve, which runs to the tip of the wing, the space between it and the front margin of the wings forming one or two cells, which are termed the marginal or radial cells, *a*, behind this nerve, and running somewhat parallel with it, is another nerve connected with the former by various short transverse nerves, the space between which forms the submarginal or cubital cells, *b b b b*, varying in number from one to four; there are other nerves forming basal and discoidal cells, but the former are of the greatest importance, being employed as affording constant characters in the discrimination of genera. There is, perhaps, nothing more strikingly calculated to prove the beautiful order and certainty existing throughout nature, than is exhibited by these slender and apparently trivial nerves, which maintain their position in every individual of a given species, although in the adjacent species the situation of some one or other of them may be altered. Of such importance, however, is the consideration of these nerves, that in the latest work upon the Hymenoptera (St. Fargeau, *Hist. Nat. des Ins. Hymenopt.* Paris, 1836.) we find upwards of five and twenty pages devoted to their illustration. We have here represented the an-



terior wing of gorytes, in which we have a number of cells; but in some groups the number of the nerves is greatly diminished, and in few, as the Chalcididæ and Proctotrupidæ, the nerves are almost, and even absolutely and entirely, obliterated. In many of these insects, a remarkable apparatus exists, whereby the two wings on each side are kept steady together in flight, consisting of a series of very minute hooks or crotchets discoverable under a good magnifier on the anterior margin of the posterior wings. They have been noticed by no other authors than De Geer and Kirby, the latter of whom observes, that they are much more conspicuous in the bees than in the winged ants. The legs, which are six in number, are inserted on the lower side of the thorax, and consist of various pieces, which contribute to their movements. These pieces are the *coxa*, a short piece connecting the leg with the thorax, *trochanter*, another short piece articulated between the coxa and the following piece, and which in the ichneumonidæ, is divided into two parts; the femur, or thigh, which is long and

robust; the ibia, or shank, which is more slender, and terminated by one or two spurs; and the articulated tarsus, which constantly consists of five joints, the fifth being of a conical form, the extremity being the thickest part, and furnished with two strong but small claws, between which the pulvilli, or cushions, are often to be observed. These legs, which are, in fact, the chief organs whereby the insects are enabled to carry on their varied economy and habits, are necessarily very varied in their form, and in the appendages with which they are furnished. The abdomen, which is also of a very varied form, is attached to the posterior part of the thorax, either by its entire width, in which case it is said to be sessile, or by means of a slender peduncle, or foot-stalk, which in some groups is also long as the abdomen itself. At the extremity of this abdomen, on its lower surface, is attached the ovipositor, saw, or sting above mentioned, each of which, although varied in form, so as to suit its intended uses, is but a modification of the same instrument. From the centre of the underside of the abdomen, near its extremity, arise two plates, each consisting of two joints, sometimes valvular, and together forming a scabbard, sometimes more slender, and resembling palpi, and sometimes very long; between these plates (which are figured in our first vol. p. 362, col. 2, fig. 1 and 2, as they exist in the bee, under the form of two flattened plates, with a pair of small terminal lobes) arise two other pieces, which are very slender, serrated at the tip in the bees, (fig. 3 and 5), but much broader in the saw-flies, and transversely striated, forming the saws with which these insects are provided; moreover, these two pieces are received, in the bees, into a canal (fig. 2 and 4), but in the saw-flies this gutter is broad, flattened, and divided into two separated parts, forming the backs of the two saws. In the ichneumons, these various parts are so slender, that at first sight they appear to consist but of a single piece; on more minutely examining the instrument, however, it will be found that it consists of a scabbard, composed of two pieces, inclosing a fine hair-like bristle, which is, in fact, the exact analogue of the stinging part of the bee's sting, consisting of three pieces.

These insects, which constitute the fifth Linnæan order, are unquestionably the most interesting of the insect tribes, comprising as they do the bee, wasp, ant, sand-wasp, cuckoo-flies, and saw-flies; the economy of which is so remarkable, that it has attracted the curiosity of the most uninquisitive persons. Their colours are seldom brilliant; brown, yellow, black, or grey, being their prevailing tints; neither do they often acquire a large size, the majority being under an inch in length, and some being so exceedingly minute as to be invisible to the naked eye, except when seen creeping against the light upon a window. Many of the species live in societies more or less numerous, as the bees, ants, and wasps; these assemblages consisting of males and females, and neuters, the latter being abortive females, and destined to perform the more laborious duties of the community. Others, as the sand-wasps, &c., are solitary in their habits, but their economy is not less interesting than that of the former; since, although not exhibiting such a variety of remarkable physiological traits, the construction of a nest, and the provisioning it with a supply of food for the young when hatched, by a single insect, is sufficient to prove that the instincts of that insect are not less developed than in cases where a particular

duty devolves upon a particular set of individuals. We have already, in our articles ANT, BEE, CERCERIDÆ, FORMICIDÆ, HORNET, &c., detailed many of the more prominent features in the economy of those insects, which it will be unnecessary to repeat in this place. From these we find that the food laid up in store by one class of these insects, consists of honey collected from flowers; whilst in another class it consists of insects deposited in cells by the parent fly. Another class have the instinct to deposit their eggs in the already provisioned cells of the working classes, the young of which latter are starved to death by the previous exclusion of the parasitic grub, which devours the supply provided for the former. Another class is parasitic in a different sense of the word, depositing their eggs upon or within the bodies of other insects, chiefly in the larva state, the intestines of which are preyed upon by the grubs when hatched. Others deposit their eggs in the leaves or stems of various plants, together with an irritating matter, which causes the production of galls or warts, often of a large size, upon the substance of which the larvæ, when hatched, continue to feed until they assume the perfect state; and the remainder place their eggs in slits in the stems of plants upon the leaves of which the young feed. From the nature of their food, and their abode in the midst of it, it will be at once evident that they have little need of locomotive organs serving for its discovery. We accordingly find that the majority of the hymenopterous larvæ are footless grubs, of a white colour, and of a fleshy substance, having the parts of the mouth small, and but slightly developed, although in the perfect insect the same organs attain a maximum degree of development. In those larvæ, however, which are external feeders, we find the necessity for locomotion causing the addition of locomotive organs; the legs in the larvæ of the saw-flies varying in number from six to twenty-two. The pupæ of these insects are inactive, having the various limbs of the perfect insect developed, but enclosed in separate cases, and lying along the breast. In this respect, therefore, they resemble the coleoptera, and like them they are in this state either enclosed in cocoons formed by the grubs previous to their transformation, or are naked. The species of this order is extremely numerous. They are annual insects; the majority of them pass the winter season in the form of grubs or pupæ, whilst others pass this period in the perfect state. These, however, are but few in number, and consist of females which have been impregnated during the preceding autumn, and are destined to become the foundresses of fresh colonies, upon the arrival of spring. In their perfect state, they feed almost exclusively upon the honey of flowers. Some, indeed, have been said to feed upon other insects, but these observations have been made upon a casual occurrence, or upon insects which were in the act of securing the supply of food for their progeny. In the tropical countries, the species attain the largest size; there, too, they appear to be the most abundant.

The situation of this order in the classification of insects, is especially interesting. The possession of a pair of robust mandibles necessarily places it amongst the mandibulata or masticating insects, whilst the elongated structure of the lower parts of the mouth, forming a proboscis for sucking up the honey of flowers, seems to unite it with the haustellated or sucking insects. Latreille has accordingly placed it between the mandibulated *Neuroptera* and

the suctorial *Lepidoptera*. This order has been considered a very natural one by all entomologists. Our great author, Ray, was the first who had any idea of the group, which was named by him *Tetraptera* or *Quadripennia*; but he included therein the *Phryganidæ* and *Ephemeridæ*. It was not, however, until the tenth edition of the *Systema Naturæ*, that the order was reduced to its present limits. In the twelfth edition of the same work, three hundred and fourteen species were described, but the number is now vastly increased. The increase in the number of genera has kept pace with that of the species, so that, had it not been for the philosophical institution of family groups, by Latreille, corresponding in many instances with the Linnæan genera, this and the other orders of insects would have become a perfect chaos. The structure of the parts of the mouth, as appearing to indicate the essential habits, might be regarded as of primary importance in determining the classification of the insects; but it is essential to bear in mind the following circumstances, which may have the effect of proving that too great a weight ought not to be allowed to these considerations. We have already said that the *Hymenoptera* in general feed upon the honey of flowers—hence, unlike the *Coleoptera* (in which some are predaceous, others lignivorous, others herbivorous, and others necrophagous) an uniformity in the mode of nourishment exists; the only variation consisting in the employment of the sap exuding from the wounds of plants, or the juices of fruits. If, indeed, certain of the *Tenthredinidæ* (such as *Tenthredo scrophulariæ*) attack other insects, they form but an exception to a general rule, which they and some other species infringe but rarely, and, as it would seem, only when the excessive heat has dried up the supply of honey. The ants and wasps also appear to offer exceptions to the rule, but it is not real, since as they are often found upon flowers, of which they will suck up the honey, it is presumable that this is their ordinary food, and that if they destroy other insects, it is only for the purpose of getting at the honey with which the latter are gorged. Moreover, in the nests of certain social wasps, and even in that of the *Polistes Licheguana* of Brazil, as observed by M. Auguste de St. Hilaire, a quantity of cells, full of honey, have been found, of which this distinguished traveller ate a considerable quantity without experiencing any inconvenience; and the same has been observed in respect to the honey found in the nests of *Polistes gallica*. The larger species of wasps will occasionally attack raw meat in butchers' shops; but this is of rare occurrence, and can be only attributed to an occasional diminution of their ordinary food; indeed many nests are too far distant from the habitations of man, for the wasps which inhabit them to have recourse to such a kind of food. In the same manner may be explained the interesting instance of supposed instinct exhibited by a wasp, recorded in some of the popular works on natural history, which had captured a fly which it was unable to fly away with, owing to the wind acting upon the wings of the latter, whereupon it clipped off these wings and also the legs, and then flew off with it to devour it at leisure. Here it was evident that the wasp had been prevented from obtaining its usual supply of food, and that its instinct had been sharpened by hunger. We were witness some time ago of another equally interesting instance of instinct exhibited by the same insect, which had discovered some flies upon which it wished to make a

meal, revelling upon excrement, which it was anxious not to touch with its feet or wings in seizing its prey. It approached, therefore, as near to one of the flies as it could, and then with a swoop, which reminded us of the flight of the hawk, darted upon the fly, and carried it off without soiling itself. The ants, in like manner, although some of them have the instinct to secure in their nests entire colonies of aphides, do not devour them, but merely lap up with their tongues the saccharine fluid which they emit, and which is, in fact, merely vegetable liquid slightly modified during its passage through the body of the aphid. All other species of hymenopterous insects observed killing, wounding, or dragging along other insects, caterpillars, or spiders, have been ascertained to be employed, not in providing for their own support, but for that of their offspring. The elongation of the parts of the mouth of the *Coleoptera*, has been regarded as a character indicating carnivorous appetites; and hence the same idea has been applied to those hymenoptera which have the trophi, especially the jaws, elongated; but observation has proved that these species are destined to carry heavier burdens than the others; their prey destined for their progeny is more weighty, and they consequently need more powerful tools for its transport. Now the *Coleoptera* have no work of this kind to perform, and consequently the analogy cannot be supported: and this observation, as it appears to us, offers an interesting clue to the solution of the oft-debated question, why it should be requisite to employ characters derived from so many distinct organs in the natural classification of any extensive group of animals, instead of deriving them throughout the group from a single organ.

In one order of insects, for instance, we find the primary divisions founded upon variations in the construction of the tarsi, whilst in other orders the structure of these parts is uniform. Thus it is only by acquiring a perfect knowledge, not only of the structure, but of the habits of animals, that we can ever hope to be made acquainted with the relative value of this or that character, so as to be able to affirm, with any thing like precision, that the one or the other is of the greater importance; and this happens to be a question of considerable moment in respect to the order at present under consideration, in which some authors have distributed the families according to their general structure, whilst others, and more especially the Count de St. Fargeau, in the work above mentioned, have regarded the various instincts of the insects, as exhibited in their social, solitary, or parasitic qualities, as of the highest value, although these qualities may have but a very slight influence upon the general structure of the insect; thus between the humble bee and the parasitic humble bee (*Psithyrus*), there is so little general variation of structure, that Mr. Curtis even doubts the propriety of their generic separation, whilst St. Fargeau, looking at their different instincts, places them in totally distinct sections, regarding the slight modification of form in the legs, (dependent, it is true, upon the polliniferous or parasitic habits of the different insects), of far higher importance than that entire variation of structure which separates such families as the working bees and wasps, which are united together by the common tie of sociality. As regards the order of insects in question, this mode of viewing their classification has hitherto been too much neglected to enable us to follow it out in a work like the present, which ought to

convey facts rather than theories ; we have nevertheless thought it proper to notice the subject, which is in fact one which materially influences every zoological group. In the meantime it may be more conducive to our present purpose to notice the variation of several of the more important organs, and the causes upon which such variations are dependant. Although the nature of the nourishment of all hymenopterous insects be alike, it does not follow that the mouth of all should be of an uniform structure ; neither, although consisting of the same parts and number of pieces, is it requisite that they should be formed upon the same model. The construction of the nest and the preparation and transporting of the materials employed therein, as well as the form of the flowers from which the different species collect their honey, are considerations which modify, in a greater or less degree, the structure of the organs of the mouth ; thus in those species which collect honey from flowers for their own support alone, as the *Tenthredinidæ*, *Ichneumonidæ*, &c., the lower lip or tongue and the lower jaws are short and narrow, but when the insect has to collect a supply of food not only for its own support, but also for that of its progeny, these parts are much more developed, as is also the case when the honey is placed at the bottom of tubular flowers, such as the *Labiataæ*, &c., which are much frequented by some of the long-tongued bees ; the same parts are short and broad in the ants, wasps, &c., because they frequent flowers composing the heads of the *Umbelliferæ*, from the almost flat surface of which they collect the honey, as well as the sap flowing from the wounds of trees, &c., without trouble ; moreover, this organ is thus modified to serve as a trowel for the smoothening of the inner surface of the cells in which the future progeny are to be produced. Again, in those species which have to search with much diligence for the prey destined for the nourishment of their progeny, the palpi (which appear to be organs of touch) are elongated ; whereas in those whose larvæ are nourished with honey, they are short, the flowers being discoverable without difficulty by the sight or by the antennæ. Again, the mandibles vary in their form, size, thickness, and toothing ; thus, in the females of some genera, they are more robust than in the males, the former sex being the sole architect of the nest, and having to perform more laborious work than her partner ; so in those females which have to cut the materials for their nests, they are thicker, whilst in those which have heavy burdens to carry, they are longer ; but the most extraordinary instance of this kind of variation in the last named organs occurs in the neuters of some species of ants. Many observers have remarked in the same nest neuters with large and others with small jaws, the former being employed in collecting food, and the latter remaining in the nest, out of which they only make their appearance to attack any enemy that may menace their community. M. Carcel was witness of this fact (first observed by the celebrated Huber), the former of whom was witness of the destruction of a scorpion by these minute but extraordinarily developed workers. M. Le Prieur has also observed that the nests of the South American visiting ants (*Atta*, Latreille), the neuters of which have short jaws, are defended by other workers with exceedingly long mandibles ; which organs are employed in stopping those individuals which quit the ranks and might thus be lost, showing them the right way. Latreille, not being aware of this remarkable

fact, has formed these long-jawed individuals into a distinct genus under the name of *Eciton*.

Many other equally interesting instances might be given of the variations and causes of variations to which not only these but other essential organs, as the ovipositor, legs, &c., are subject ; but we have advanced sufficient to prove that this branch of the subject, which may without hesitation be laid before the reader almost as an unopened field of inquiry, possesses a very great degree of interest, sufficient to repay the labour devoted to its elucidation.

The following is the classification of this order, given to us by Latreille, to whom indeed we are greatly indebted for our knowledge of these insects, which were especial favourites with this celebrated author.

Section I. TEREBRANTIA ; abdomen of the females furnished with a saw or borer.

Sub-sec. 1. *Securifera* ; abdomen sessile furnished with a saw ; larvæ with feet. Families, *Tenthredinidæ* (saw-flies), *Siricidæ*.

Sub-sec. 2. *Pupivora* ; abdomen pedunculated, furnished with a borer ; larvæ without feet. Families, *Evanidæ*, *Ichneumonidæ*, *Cynipidæ*, *Chalcididæ*, *Proctotrupidæ*, *Chrysididæ*.

Section II. ACULEATA ; abdomen of the females (and neuters) armed with a sting.

Sub-sec. 1. *Heterogyna* ; females or neuters wingless. Families, *Formicidæ* (social), *Mutillidæ* (solitary).

Sub-sec. 2. *Fossores* ; females winged, wings not folded, basal joint of posterior tarsi simple. Families, *Scoliidæ*, *Sapygidæ*, *Sphegidæ*, *Bembecidæ*, *Larridæ*, *Nyssonidæ*, *Crabronidæ*.

Sub-sec. 3. *Diploptera* ; females (and neuters) winged, wings folded. Families, *Masaridæ*, *Vespidæ*.

Sub-sec. 4. *Mellifera* ; females (and neuters) winged, wings not folded, posterior tarsi with the basal joint large and compressed into a polliniferous organ. Families, *Andrenidæ*, *Apidæ*, with its subdivisions, for which see our article APIDÆ.

HYOSCYMUS (Linnæus). A genus of annual and perennial herbs, natives of Europe. One of them, the *H. niger*, is the well-known henbane of British wastes. These plants belong to the natural order *Solanææ*. The henbane is a powerful narcotic, and, when taken in any considerable quantity, proves quickly poisonous to man, and most brute animals except swine.

HYPERECINEÆ. A natural order of plants, of which *Hypericum* is the type. It contains seven genera, and above ninety species. The whole abound in a resinous juice. Their leaves are all dotted, and, what is very remarkable, the dots are often black, even upon the yellow petals. They are herbs, undershrubs, or trees ; the stems are jointed, and the intermediate joints are round or tetragonal ; the leaves opposite simple, entire, very seldom alternate or crenate, and either sessile or short-stalked. The inflorescence is mostly in terminal cymes ; the flowers are regular, united, and in general yellow ; the fruit is capsular, or baccate, many-valved and many-celled. The plants of this order are found in the more temperate parts of Europe and Asia, and often in the shady parts of woods. The genus from which the order receives its title is the *Hypericum*, or St. John's Wort of English authors, seven or eight species of which are natives of this kingdom.

HYPOXIDEÆ. A natural order of exotic plants, containing three genera and about twenty species. *Hypoxis*, the genus whence the order is named, was formerly associated with the *Asphodeleæ*, till separated therefrom by Dr. Brown. It seems to be a link of connexion between them and the *Amaryllideæ*, from which last it but slightly differs. The foliage of these plants is plaited, harsh, and rigid, which circumstances seem to argue them distinct from both *Amaryllideæ* and *Asphodeleæ*. *Hypoxis*, *Curculigo*, and their few allies at present known, are plants of little beauty, *H. stellata* excepted. Their uses are unknown.

HYRAX (*Hyrax*). A genus of pachydermatous mammalia, intermediate in their character between the rhinoceros and the tapir; but so inferior to them in the size of the existing species, that it was not until Cuvier had demonstrated the character of the animal from its anatomical structure, that it was admitted into this part of the system; and it was previously classed by naturalists with the rodentia or gnawing animals. No part of the structure allows it, however, to be ranked with them, while every thing justifies the place assigned to it by Cuvier. The general appearance is that of a rhinoceros in miniature; and though it has no horny production on the nose, it has the same character of the grinders, and the same prehensile upper lip. The incisive teeth are different, for there are in the upper jaw two large incisors bent backwards, with a wide space between them and the cheek teeth. The foremost cheek teeth above have flat triangular crowns, and the posterior ones are a little hollowed: the under ones have transverse ridges on their crowns. In the full grown animal, there are no canines; but in the young state, there are small ones, which soon drop out, and are never replaced. The incisors in the lower jaw are four in number, and much smaller than those in the other; but they are, properly speaking, tearing teeth, and not cutting ones, though from the character of the cheek teeth, they are made for tearing vegetable matter only; the fore feet are furnished with four toes in one of the known species, and only three in the other, while the hind feet have four toes in both; the claws upon these toes are, properly speaking, little hoofs, which are the characteristic armature of the pachydermata, but the inner toe of the hind foot is furnished with a crooked claw; the nostrils are oblique; the eyes small; the ears short, but of considerable size; the head large for the size of the body; the upper lip divided; six mammæ in the females, two on the breast, and four on the belly; and the body covered with two descriptions of hair, one short and woolly, and the other long and silky; internally, the stomach is divided into two portions; there is a large cœcum, and various enlargements in the colon. All these characters are strictly those of the pachydermatous animals, and leave no doubt as to the correctness of the modern arrangement.

It is not a little remarkable that we should find the remains of those smaller animals of this order in the places where the largest ones are also found; and it is especially curious that we should find both species of this genus in Africa, on opposite sides of the equator, and nearly under the same meridian. This would lead us to conclude that at some early period of its history, the character of a large, and probably the principal part of the African mammalia, was pachydermatous; but that in the progress of the country toward dryness, those heavy and comparatively slow-

going animals, have given place to those ruminants, which are found in such multitudes upon the African plains. We have not space, however, for entering upon this speculation, and all that we can do is to refer it to the attention of the reader. We shall, therefore, now only notice the two species.

CAPE HYRAX (*H. Capensis*). This one has four toes on each of the feet; is of a greyish brown on the upper part, and whitish on the under, and also the insides of the ears. It has been called a marmot by naturalists; and the colonists of Southern Africa have termed it the rock-badger. It is about two feet six inches in length, from the muzzle to the extremity of the body; it has no tail, except a mere tubercle; and it stands about eight inches high on the legs. It lives in the clefts of the rocks, where it contrives to secure itself tolerably well from beasts of prey. The woolly hair upon it is fine and soft; and the silken hair is pretty long and of irregular length, so that some hairs of it project much farther than others. The soles of the feet are covered only with a thick soft skin. It is a docile animal; not very difficult to tame; playful when in a domesticated state, and capable of a considerable degree of attachment.

SYRIAN HYRAX (*H. Syriacus*). The chief difference between this species and that found in Southern Africa consists in its having only three toes on each of the fore feet, while the other has four. It is found as far to the southward as Abyssinia; and is the *ash-koko* of that country described in Bruce's Travels, the fidelity of which in natural history, as well as in all other matters, has been so fully established by the testimony of more recent travellers. It has sometimes been alleged that there are other and smaller species of this genus; but it does not appear that the allegations are entitled to credit. The hyrax possesses twenty-one pairs of ribs; the elephant and tapir twenty; the rhinoceros nineteen; and the solid-hoofed animals eighteen.

HYRIA (Lamarck; *Mya*, Gmelin). Lamarck separated this genus from those of *Mya*, *Unio*, and *Anodon*, with which they had previously been blended. These molluscs differ from the *Unio* not only in general shape, but in the form of the cardinal tooth, particularly that of the right valve. They much resemble the *Aviculæ* in appearance, and probably inhabit lakes rather than rivers. The substance of the shell is solid and beautifully pearly; it is equivalve, obliquely triangular, auriculated, and the base truncated and straight; the hinge with two projecting teeth, one of them posterior or cardinal, divided into numerous divergent parts, the anterior ones smaller, and the others anterior or lateral, being very long and lamellar; the ligament is linear and external. They possess a strong epidermis, and the animal entirely resembles the *Anodon* in its organisation. Strictly assuming Lamarck's definition of this genus, but two or three species would be known; but more recent authors on malacology have determined upon making the hyria no other than a sub-division of the genus *Unio*, in which also another of Lamarck's genera, *Castalia*, is now considered only a sub-division; and we feel disposed to place Dr. Leach's *Dipsas* in the same situation. Considering, therefore, the family *Unio*, their number is immense, and daily increasing by the extended researches of naturalists. The genus *Hyria*, as above defined, inhabit America, and many new species may be discovered in other parts of the warmer climates of the south.

IANTHINA (Lamarck ; *Helix*, Linnæus).—This singular shell was confounded by Linnæus with the genus *Helix*, the impropriety of which may at once be pointed out by stating that the *Ianthina* is a marine, and all the *Helices* are terrestrial molluscs—in general form, also, it varies from the *Helix* in many respects when examined with any thing beyond a cursory glance. The shell is extremely fragile—thin, transparent, and imbued throughout its substance with a beautiful violet colour. The form is round and ventricose, the whorls slightly angular, spire obtuse, columella straight and continued below the base of the right side, occasioning an angle to be formed at the lower part of the aperture ; a sinus or notch exists in the margin of the lip, but it is seldom met with in a perfect state from the extreme delicacy of the shell ; and some authors are of opinion that it only occurs in the female species. These shells are found floating on the surface of the sea, suspended by a bladder-like appendage attached to the animal's foot, and closing the aperture of the shell in the manner of an operculum ; from this a violet liquor is emitted when the animal is touched or injured, whence the name of the genus is derived. Many naturalists were of opinion that this vesicular appendage contained the eggs of a future generation ; but this appears unlikely, as every species is furnished with it ; and if the assertions of the late Sir Everard Home are to be credited, he has seen the eggs of this mollusc dispersed on the exterior of the shell, and thus carried to a certain period of their development, which he adduces as one of the few instances known, of any thing like a superior instinct being exhibited by molluscous animals in the care of their progeny. The facts cannot, however, long remain doubtful, as one species is not very rare in our seas, though the other inhabits the warmer latitudes. Supposing the notch in the lip of the shell to constitute a distinction of sex, no subdivision of the genus would be necessary ; and as there are but three or four species known, that question cannot, as yet, be conclusively answered till further observation shall have determined the position of the eggs, and proved, as appears most likely, that the bladder-formed appendage to the animal's foot is merely a wise and necessary provision of nature to assist locomotion, since without it the specific gravity of the shell would be greater than the medium through which it is seen to travel or become suspended. Some of the aquatic insects are beautifully provided with the faculty of expelling small air-bladders to their covering, by which their rise to the surface of the water is facilitated, or altogether accomplished ; and the absence of such a provision as that we speak of in the animal—found in the *Argonauta*, has been often urged in evidence of its being a pirate, and not the “architect of its fairy boat.” That the wisdom of the Almighty Creator of all things is manifested as much in the smallest work of nature as in her stupendous productions, all rational beings will confess—but to fathom the full extent of that wisdom, is not allotted to man ; all he can do is by patient investigation and continued reasoning to assign some probable effect to certain natural indications, and this leads him to the beautiful results of a knowledge of comparative anatomy, and a greater reverence towards Him, who said, Let it be, and it was.

IBERIS (Linnæus). A genus of annual and biennial herbs, and perennial under shrubs, mostly natives of the south of Europe. They belong to *Cruciferae*,

and are well known by the name of candy-tuft, so frequent in every flower border. *I. odorata* is fragrant as well as pretty, and the whole genus is remarkable for the cruciform corolla becoming irregular, the two outer petals of the external flowers in its dense corymbose panicles being longer than their fellows, and even ligulate.

IBIS. A genus of *Echassiers*, or stilt birds, belonging to the family of birds with long bills, and resembling the curlews more than any other genus. They are of larger size, however, and, generally speaking, inhabit warmer countries, where they frequent the margins of the larger rivers. The true ibis appears to be confined to the eastern continent, though the American genus, *Tantalus*, which agrees with it in many habits, and answers the same purposes in that quarter of the world, as the ibis does in the east, has sometimes been confounded with it. The characters of the genus are : the bill long, slender, arched, enlarged at the base, and depressed at the tip, which is rounded and obtuse ; the upper mandible furrowed with deep nasal grooves for its whole length ; the nostrils placed in the base of the upper mandible, and partially covered by a membrane which also lines the nasal groove ; the front, and often part of the head covered with naked skin ; the feet very slender, and having a naked garter above the tarsal joint ; four toes on the feet, of which the middle and upper ones have pretty large webs, and the middle and inner shorter ones, and the hind toe sufficiently long for touching the ground. Some species, however, have the tarsi short and with reticulated scales, and these have the tarsi and also the bill comparatively stout. The others have the tarsi shielded with plates, and their bills are in general smaller.

SACRED IBIS (*I. religiosa*). This bird has been very celebrated from comparatively remote antiquity, for its real or supposed services to the ancient Egyptians, in destroying offensive and poisonous reptiles, and generally for scavengers' work done about the temples and houses. For these reasons it was admitted into the temples themselves among the numerous other animal gods of the Egyptians ; and mummies of it were preserved with the same assiduous labour of embalming as those of men and monkeys. Notwithstanding this ancient celebrity, however, and the pains which were taken to perpetuate specimens of the carcass of this animal, those schemes did not accomplish their purpose ; and in times comparatively modern, there have not only been disputes about which species is the sacred ibis ; but some have contrived to mystify the matter to such an extent, that, if we did not possess the living bird to which we can appeal for its own history, we should have remained ignorant as to what bird received those high honours in the olden time.

Bruce was the first who, in modern times, gave an accurate account of the bird ; but it was not until other evidence had been produced in corroboration of his statements, that he received the credit to which he is so well entitled. This bird is not confined to Egypt, but is very generally distributed throughout Africa. It is a bird about the size of a common fowl, with the plumage entirely white, except the quills, the points of which are black, and the last coverts of the wings have long and slender barbs also of a black colour, and with violet reflections, which hang down over the extremities of the closed wings and the tail

the bill and feet are also black, and so is the naked skin on the head and neck. These birds are very common in the central parts of Africa, and also in that part of the valley of the Nile which is liable to be flooded. Sometimes they are found solitary, and at other times they are found in groups, but seldom more than ten or twelve are in close society with each other. A number of these little groups are, however, often found close to each other, especially after the water of the Nile has begun to subside, and the banks are for some extent covered with soft mud. This mud they search with the most patient industry with their bills; and in moving about while on the ground they do not hop and run nimbly as the curlews do, but march along with measured steps; when on the wing they project the head forwards and the feet backwards; but there is not the same majesty in their aerial journeys as there is in those of the storks and cranes, neither do they extend their migration so far to the northward. Their flight is powerful, however, and they rise to a great elevation.

It does not appear that there is a very great deal of foundation for that clearing of the country of poisonous reptiles, on account of which the Egyptians are said to have held the ibis in such veneration; for the chief ground adduced for this propensity in the old account given by Herodotus, is the antipathy which the ibis had to the serpent race. In consequence of this the bird is said to have acted the part of a sort of preventive service, to hinder the serpents from smuggling themselves into the Egyptian territory. Now this is so contrary to the whole tenor of animal conduct, that it can hardly, in the nature of things, be true. Animals do not kill each other from what we call antipathy, unless in the case of those males which fight battles of gallantry for their females—we believe the propensity goes no farther; and the greater number of them, whether mammalia or birds, are vegetable feeders, and never kill other animals for the sake of eating. On the other hand, we believe there is no animal which kills, or even offers to injure, any other species, except for the purpose of feeding on that species; and, therefore, if the ibis have been a serpent-feeder, it must have eaten the reptiles from liking them, and not from antipathy to them. Besides, there are not in those places of the country to which chiefly the ibis resorts, very many serpents for the birds to eat, either from liking or disliking. Water serpents are not, we believe, very numerous in the Nile; and the land serpents of Egypt are chiefly, if not exclusively, found in the dry and sandy places in which the ibis seldom if ever seeks its food; besides, the bill of the ibis is not of a very serpent-killing character; for though it is stouter and harder than the bills of the true snipes, and even than that of the curlews, it is still a bill of the same class. Birds with the more characteristic bill of this form feed chiefly upon small mollusca, and other little animals which they find on the moist surface of the ground, or in the sludge; and so far as has been observed in modern times, the ibis seeks its food in similar places, and hence we may conclude, that it feeds on substances of a similar kind. Birds which do feed on serpents are always very long in the tarsi, which is not the case with the ibis, and they also have powerful bills. Cultrirostral birds, such as cranes and storks, and the other birds of that family, are more likely to perform this office than such a bird as the ibis. It

may be true, however, that the America species of *tantalus*, which is a hard-billed bird, and does eat reptiles, may have been confounded with the ibis in ancient times, as it has sometimes been by modern naturalists.

GLOSSY IBIS (*I. falcinella*). This is a much more discursive bird than the preceding species; and though it ranges over the tropical countries, and appears to have its head-quarters there, yet it makes excursions over a considerable part of Europe. The characters are: the head, the neck, the front of the body, and the sides of the back, of a beautiful chestnut colour; the upper part of the back, the wings, and the tail, are of a bronze or golden-green, as the different shades of light reflect upon them. The bill is greenish black, and the tip brown; the irides are also green, and the legs are greenish brown. It is about twenty-three inches in length. The young have the head, throat, and neck feathers striped with blackish brown before they reach their third year. These feathers by this time are also margined with white. The breast, the belly, the thighs, and the under part of the neck are of a black ash colour, the upper part of the back and scapularies brownish ash, and the golden green reflections of the wings are of a duller hue than in the adult birds. It haunts the margins of the lakes and rivers, and visits, in passing, Poland, Hungary, Turkey, and the Archipelago. It is also met with on the banks of the Danube, and frequently in Switzerland and Italy, and occasionally, though more rarely, in Holland and the British islands. It is not uncommon in Egypt, where it appears as a regular visitant at that season when water birds resort in such numbers to reap their portion of the harvest of the Nile. As a European bird, however, it belongs much more to the eastern migration between the valley of the Danube and the rivers of central Asia, than to the southern migration. Its breeding places are not correctly known; but they are understood to be chiefly in Asia. The food consists of insects, worms, fresh-water mollusca, and occasionally vegetable substances; and from the generic resemblance that there is between them, there is every reason to believe that the food of the Egyptian species is the same. The young of this species have sometimes been described as a different one, under the name of the green ibis. Indeed the names ibis and *tantalus* have been so habitually given to the same birds, that there is a great deal of uncertainty about both genera. There is no doubt, however, that Cuvier is correct in ranging *tantalus* among the birds which have knife-shaped or trenchant bills, which are capable of mastering animals of considerable power; and ibis among those which have long bills fitted for dabbling. In the present genus the bill is not so completely covered with sentient membrane as in some of the others; but still there is no doubt that the lining of the nasal grooves is an organ of sense. We shall have occasion to revert to the place of these birds in the system when we come to the article **TANTALUS**.

ICE PLANT is the *Mesembryanthemum crystallinum* of Linnæus, a curious annual, very frequently seen in our green-houses. The plant belongs to the natural order *Ficoideæ*.

ICHNEUMON (*Mangusta*). A genus of carnivorous mammalia belonging to the family of *Viverridæ*. The characters are: six incisors, two canines, and twelve grinders in each jaw. Three of those in

the upper are false grinders; and there is one large carnivorous tooth, and two tuberculated ones. In the lower jaw there are four false grinders, one large carnivorous tooth, and one large tuberculated one. The head is long; the muzzle pointed, the pupils of the eye contract to a line; the tongue is rough; there are five toes on each foot, and the animals are furnished with an anal pouch of considerable size. There are several species, all natives of Africa and south-eastern Asia. They are animals of small size, of prowling dispositions, but not remarkable for ferocity. Figures of the two best known species are given in the plate ICHNEUMON, and we shall first very briefly notice them.

EGYPTIAN ICHNEUMON (*M. Ichneumon*). This species inhabits the banks of the Nile; and it has been scarcely less celebrated than the ibis itself. It is too weak and too timid for being able to attack adult crocodiles, serpents, and the larger lizards; but it is by feeding on their eggs and destroying the young that the ichneumon decreases the number of these obnoxious creatures. It is not an animal of a decidedly carnivorous appetite, though it occasionally lives on animal food. When urged by its natural instinct of destruction, it is often met with after night-fall cautiously prowling along the rough surface of the soil in search of its prey, and at the same time cunningly avoiding all appearances of danger. When it is fortunate enough to succeed in these researches, it does not stop with the gratification of its appetite, but goes on destroying every animate creature it can safely attack. It is particularly fond of eggs, which it seeks after with great assiduity, and the gratification of its palate in this way causes the destruction of a great many crocodiles. It is a mere fable that it enters the mouth of the crocodile when asleep; but such fables are very common in all countries in the age of superstition.

These animals possess a considerable degree of sagacity, and have a strong disposition to explore and scrutinise places which are new to them. The sense of smell appears to be of great use in guiding them to their prey: but their other senses are not so acute. It waits and watches with great patience, and also shows much perseverance in search of prey. On these accounts, and from its comparatively gentle disposition, it is pretty generally kept in a state of domestication, in which it answers nearly the same purpose as the domestic cat. In this state they readily know the houses of their keepers, and those persons who feed or otherwise kindly use them, though they do not show any sign of the watchfulness and attachment of the dog. They are, however, not insensible to caresses; and though they are apt to be sulky if disturbed when feeding, they never attempt to regain the wild state after they have been once domesticated.

THE INDIAN ICHNEUMON (*M. Mungos*). A figure of this species is given in the same plate with the former, from which some general notion of the aspect of the animal may be formed. It is of a dull grey colour, arising from the marking of the hairs, which is an alternation of rings of black and white. The tail is of the same colour as the body, very thick at the basal part, but tapering to the extremity, a small portion of which is yellow. It is smaller than the African species, being little more than a foot in length, and five inches high in the most elevated part of the back; but the tail is very long, nearly equal to

the whole length of the body. It is very common in many parts of India, and so far from shunning the habitations of men, it often takes up its abode in holes of the walls of houses, or in small burrows in the ground, which it digs with great readiness. It is easily tamed, and when fed it is playful; but the sight of those animals which form its natural prey excites it so much that it is apt to bite, if not released so as to be suffered to pursue them. It partakes a little in the habits of the cat; and one might expect as much from all the species, inasmuch as they have the claws semi-retractile, and use them partially in capturing their prey. It is exceedingly fond of birds, and very dexterous in seizing them. It jumps upon them like a cat, with far more rapidity than one would expect from the general appearance of the animal.

There are several other species, or at least varieties, found in the eastern peninsula of Asia, and in Java and the other islands situated around the extremity of that peninsula. The chief difference among these is difference of colour, which renders it not improbable that they are all originally of the same stock. The one which inhabits Java is found most abundantly in the forests of large trees. It is an active and energetic animal, not indisposed to associate with man, but rather destructive of eggs and young birds in the poultry-yard. From the accounts that are given of it, it appears to be more sensitive to kindness than the other species; for it follows its master like a dog, stands up on its hind legs to be played with and caressed, and shows other evidences of being pleased with attention. Some of the animals which probably ought to belong to this group are placed in other genera; so that we shall notice the remainder of them, and also the general relations of the family, in the article VIVERRIDÆ.

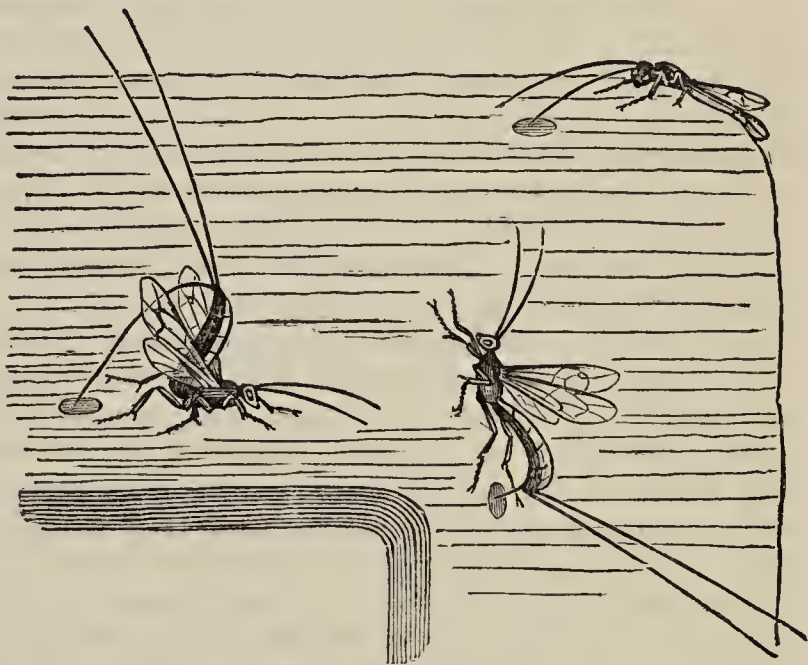
ICHNEUMONIDÆ (Latreille). A very extensive tribe or family of *Hymenopterous* insects belonging to the section *Terebrantia*, or those destitute of a poisonous sting, and subsection *Pupivora*, Latreille, or those which are parasitic upon other insects. In this family the wings are furnished with various veins, the anterior pair having several complete and closed cells. The abdomen, which is narrowed at the base, is inserted between the posterior pair of legs; the antennæ are long and filiform, or setaceous, composed, for the most part, of a very great number of short, cylindrical joints. They are constantly kept in a state of vibration. In the majority the jaws are not furnished with a strong internal tooth, and they are generally slit at the tips. The maxillary palpi do not generally consist of more than five joints, which are long and slender; the ovipositor, which, as we shall subsequently see, is an organ of the greatest importance in the economy of these insects, is composed of two external filaments enclosing a slender cylindric instrument which, although apparently consisting of a single piece, is, in reality, formed of a sheath inclosing two very delicate and serrated threads.

These insects were named by the old authors *Muscæ tripiles*, from the three setæ which compose the ovipositor, or *Muscæ vibrantes*, from the constant vibration of the antennæ, which are often curled at the tips with a band of white or yellow towards the middle; the body is generally long, slender, and narrow; the ovipositor sometimes being protruded to a very great length, far exceeding that of the entire body, and sometimes being so short that it is not externally visible, in which case the body is pointed at

the tip; in the former case the abdomen is thickened at the extremity, and obliquely truncated. The central piece of the ovipositor is the only part which is employed in introducing the eggs of the insect into the bodies of those insects which are selected by the females for their reception; it is more horny than the external sheaths, and of a brighter colour. Although this instrument is very analogous in its construction to the sting of the bee, it cannot in strictness be regarded as such an organ, although the ichneumon, when held in the fingers, endeavours to employ it in a similar manner by attempting to prick the hand; no ill effect, however, is to be apprehended from the workings of the instrument: in those species, however, which have the ovipositor short, the organ is certainly capable of piercing the skin in tender parts, and of causing a slight pain, arising, probably, rather from the wound than from any deleterious fluid introduced at the time. These insects were comprised with some other parasitic groups, as the *Chalcididæ* and *Proctotrupidæ*, in the Linnæan genus *Ichneumon*, a name given to these insects by the ancients, from the services which they performed to agriculturists by the destruction of vast numbers of caterpillars, in the same manner as the quadruped named *Ichneumon* was supposed to destroy the posterity of the crocodile by the Egyptians, who considered that the former animal not only demolished the eggs of the latter, but even killed the crocodile by introducing itself into its body, and devouring its entrails: the analogy does not, however, entirely hold good, since the *Ichneumon* fly merely deposits her eggs within the body of the caterpillar, the grubs hatched from which devour its entrails by degrees.

We are indebted to Mr. Marsham for an account of the proceedings of one of the largest British species, *Pimpla manifestator*, which is provided with a very long ovipositor, published in the third volume of the Linnæan Transactions, and which it may be serviceable to detail as giving a general notion of the habits of the family. This species was observed by him on the top of a post in Kensington Gardens, moving rapidly along with its antennæ bent in the form of an arch, and kept in a strong vibratory motion, and which the *Pimpla* introduced into a hole made by some insect. In this situation it remained for a minute, and then withdrew them, and going to the opposite side it again repeated this proceeding, which was a third time repeated at the side of the hole. Having again drawn out its antennæ, it turned about, and dexterously measuring a proper distance, threw back its abdomen over its head and thorax, lowering the long and slender ovipositor which it introduced into the hole, remaining in this situation two minutes; it then withdrew its ovipositor, turned round, and again applied its antennæ to the hole as before, and again inserted its ovipositor, repeating the operation three times. On another occasion, Mr. Marsham observed several of these insects at work, but these appeared to pierce the solid wood with the central part of their ovipositors, which they succeeded in doing to half their entire length, constantly supporting them in a straight position with their posterior thighs. It appeared truly surprising to see an instrument, apparently so weak and slender, able, with the strength of so small an animal, to pierce solid wood half or three quarters of an inch deep; but it was perceived that the operation took place through the centre of a small white spot, resembling

mould or mildew, which, on minute examination, was found to be fine white sand, delicately closing up a hole made by the wild bee, *Chelostoma maxillosa*, for the reception of her cells, and which, no doubt, contained the larva of that insect. The writer hereof has, however, often watched these and other species of the family boring into palings, without being able to perceive the slightest trace of any operations performed by other insects, although it is not to be questioned that the larvæ of some insect or other were ascertained by the *Ichneumons* to be in such spots, at a depth in the solid wood. In deep holes which were not closed, the *Pimpla* not only thrust in the entire ovipositor, but in some cases the whole of the abdomen and posterior legs, leaving out only the two fore legs and the wings, which it spread out in opposite directions, like arms. At such times the external cases of the ovipositor were also projected over the back, with the ends appearing above the head out of the hole. The *Pimpla*, indeed, does not adopt indiscriminately any hole for the reception of her eggs, since Mr. Marsham observed that in many instances he saw it thrust the antennæ into holes and crevices from which it almost immediately withdrew them, and proceeded in search of others; it is, therefore, only in such holes that are inhabited by the insects which are the genuine receptacles of the eggs of the parasite, that the *Pimpla* selects for the deposition of her eggs; and that this information is obtained through the medium of the antennæ, appears certain, but in what manner, and whether by the sense of smelling, or hearing, or feeling, we can by no means decide.



Pimpla manifestator engaged in oviposition.

In the insect whose proceedings we have thus detailed, we have seen that in consequence of the deep retreats in which the young of the bees are lodged, it is necessary that the *Ichneumons*, which are destined to keep them in check, should be provided with an ovipositor sufficiently long to reach them in their cells; but other species which have no difficulties of this kind to contend against, are provided with a very short ovipositor, whereby they are enabled to penetrate the soft and naked bodies of caterpillars. We have already in our account of the family, or more properly sub-family, *Braconides*, given an account of the proceedings of some of the *Ichneumons*, which are parasitic upon the plant lice. Mr. Kirby has recorded an account of one of the species which is eminently serviceable in keeping in check the little midge (*Cecidomyia*), which attacks the wheat when in flower.

Having placed a number of the grubs of this mischievous insect upon paper, he introduced a female *Ichneumon* amongst them: she immediately began to pace about, vibrating her antennæ very briskly, whereby she soon discovered one of the larvæ, upon which she immediately fixed herself, her antennæ vibrating very intensely; then bending her abdomen beneath her breast, she inserted her ovipositor, and whilst the egg was depositing, the antennæ became perfectly motionless. The larvæ when pricked gave a violent wriggle; this operation was repeated with all which had not already received an egg, for only one is committed to each larva. Mr. Kirby noticed that when it mounted one which had already received an egg, it soon discovered its error, and quitted it untouched.—(Linn. Trans., Vol. iv., p. 236.)

In the preceding instances the larva of the *Ichneumon*, when hatched, is solitary, but others are gregarious; the same *Ichneumon* depositing several eggs in the body of a single caterpillar; this is particularly the case with the little *Ichneumons* (*Microgaster glomeratus*), which prey upon the caterpillars which so often devour our cabbage, and which are the offspring of the common white butterfly (*Pontia rapæ*). These caterpillars when full grown creep up the sides of houses to the corners of window-frames, or such like places, where they are ordinarily transformed to a greenish chrysalis, which may often be seen suspended against the wall; but occasionally a great number of small white grubs are observed to burst out of these caterpillars previous to their becoming chrysalides, (which operation, of course, causes the death of the caterpillar) which grubs immediately encase themselves in little oval silken cocoons attached together round the exuvæ of their victim, and which resemble a mass of yellow silk. Sometimes, instead of bursting out of the caterpillar, they remain enclosed in it until it undergoes its transformation to the chrysalis state, out of which the *Ichneumons* burst forth in their perfect state. This variation depends upon the species of parasite as well as upon the growth of the caterpillar at the period when the eggs of the *Ichneumon* are deposited in its body; and here we cannot but admire the admirable instinct of these parasitic grubs. Had they as soon as hatched attacked the vital organs of the caterpillar, of course their supply of food would have been destroyed, and they must be left to perish, since they are not provided with feet. Instead of doing this, however, they confine themselves to the fatty parts of the caterpillar; and it is not until these parasitic grubs have nearly attained their full size, that they attack the vital organs of their victim; in order to escape from the body of which, they pierce its skin, and immediately commence the spinning of a cocoon, some bursting out on one side and some on the other; here they immediately commence the spinning of a loose covering drawing the silk out of the spinneret of their lower lip in the same way as ordinary caterpillars; these threads they cross in every direction, forming of them a support for their cocoons, which differ but slightly from those of the silk-worm as regards their consistence, being of a yellow or white colour, according to the species, and so quickly do they complete this operation, that in the course of half an hour each has encased itself in its cocoon. The stems of grasses sometimes bear the cocoons of these insects, and occasionally, but very rarely, a small case is found in the interior of bee-hives, from which an *Ichneumon* has been pro-

duced, which has probably fed upon the caterpillars which devour the wax (*Galleria cereana*). Sometimes these cocoons are banded with different colours, which Reaumur endeavoured to account for by supposing that the nature of the food of the grub would influence the colour of the silk first spun; but this would not account sufficiently for the regular bands often to be seen in the centre of the cocoon. Thus the first silk spun by the *Ichneumon* larva, and which forms the external envelopes, may be white; and the second, forming the inner coating, brown; but if the larva employs this second kind of silk in defending the two ends and the middle of the cocoon, the parts not thus thickened will remain white; and this is what takes place, as may be proved by stripping off the brown part, which is much more solid than the other part—the silk thus employed is very fine and shining, which gives the cocoons a polished appearance. Some species do not, however, form cocoons; but, on the contrary, remain enclosed within the skin of their victim, which, of course, serves them for a covering during the inactive period of their pupa state.

Reaumur discovered a cocoon upon the oak, of a remarkable construction; its form indeed resembled that of the others, and it had a white central band, but it was suspended by a long thread to a leaf or twig; the most singular circumstance connected with it however was, that when detached from the leaf, and laid in a box or upon the hand, it leaped to a considerable height, varying from half an inch to three or four inches. This motion is effected by the inclosed larva making a sudden spring in the same manner as we have described in our account of the motions of the cheesehopper; the sudden unfolding of the body, bringing the head and tail into violent contact with the inside of the cocoon, so as to impart to it a motion operating upon the surface upon which it is placed. But wherefore is it necessary that this larva inclosed in a firm cocoon should possess this faculty of leaping? We may indeed suppose with Reaumur that as the ordinary situation of the cocoon is to be suspended in the air, it may be necessary, in order to regain its position, in case it should be displaced by the wind and lodged on the surface of an adjacent leaf.

It is a circumstance of great interest in an economical view of natural history, that when any particular species of insect detrimental to our vegetable produce increases in numbers so as to be more than ordinarily destructive, its parasites are observed to increase in a much greater degree, so as to prevent the too great multiplication of the former.

These insects are very variable in size; thus some of the British species are amongst the largest of our native hymenopterous insects, and are destined to check the hawkmoths and other large lepidoptera; others, however, are so exceedingly minute as to be visible only when moving upon a window against the light. The latter, whose parasitic habits are identical with the *Ichneumons*, belong systematically to the family *Proclotrupidæ*, and are appropriated to the eggs of many insects. Thus Vallisnieri observed, "I have seen with my own eyes a certain kind of wild flies deposit their eggs upon other eggs, and bore and pierce others with an aculeus, by which they have introduced the egg;" and Linnæus has accordingly given the name of *Ichneumon ovulorum* to one of these species (or rather to two, since his descriptions are evidently drawn from two distinct species); and out of

a mass of sixty eggs of some lépidopterous insect found upon the osier, and brought to De Geer, not one had escaped the *Ichneumon*. But it is chiefly in destroying the larvæ of other insects that the *Ichneumonidæ* are serviceable, although a few instances are recorded in which the eggs are not deposited until the victim has arrived at the pupa, or even the perfect state. Of those which destroy the larvæ, the majority are internal feeders, but a few have been observed which remain on the outside of the caterpillar until it dies; of this kind are the larvæ of a large orange coloured species, *Ophion luteum*, which feed on the caterpillar of the pussmoth (*Cerura vinula*). We have already given instances of the attacks of these parasites upon hymenopterous, dipterous, and homopterous insects, in the cases of the wild bees, wheat-midge, and the plant lice. Other species of these orders are similarly infested with *Ichneumonidæ* as well as the *Coleoptera*, but the great mass of the species belonging to the family are appropriated to the order *Lepidoptera*, which they destroy in all their states, and in every situation, whether naked and exposed like the caterpillar of the cabbage butterfly, or buried in the whorls of a leaf like the *Tortrices*, or hidden in the substance of a leaf as the mining *Tineæ*.

But, as if to show the endless convolutions of the great chain of nature, these parasites are themselves subject to the attacks of other and smaller parasites belonging to the same family. Of these, various instances have been well authenticated; and it is remarkable with what admirable precision of instinct these second parasites must acquire the knowledge that particular caterpillars are already attacked by the insects which are to furnish their own progeny with support.

Latreille has divided this family into three principal groups, from the number of joints in the palpi; a character which is, however, not strictly to be relied upon in certain species.

The first group comprises those species in which the maxillary palpi are five-jointed and the labial four-jointed, and the first submarginal cell is united with the discoidal cell, and the second submarginal cell is very minute, being either rounded or square, although sometimes it is entirely wanting. This group comprises the *Ichneumonidæ* of Stephens, a family of such great extent that Gravenhorst has published a description of the European species alone, occupying nearly three thousand octavo pages. Here belong the genera *Pimpla*, having the ovipositor very long; *Cryptus*, *Ophion*, having the abdomen sickle-shaped; *Banchus*, *Hellwigia*, *Joppa*, *Ichneumon*, having the ovipositor not exerted; the abdomen, narrowed, and the base and the head transverse; *Alomyia*, *Peltastes*, and others. Mr. Stephens has described 223 species of the restricted genus *Ichneumon*, in the seventh volume of his Illustrations.

The second group comprises those species which have the maxillary palpi five-jointed and the labial four-jointed, and consists of the family or sub-family which we have already described under the name of *BRACONIDÆ*, which see.

The third group comprises those species which have the maxillary palpi six-jointed and the labial four-jointed, and comprises the *Alysudæ* of Stephens, comprising the genera *Alysia*, *Chelonus*, *Sigalphus*, and others.

ICHYOSARCOLITES. A fossil genus of shells, of which only one species is known; in general ap-

pearance it may be said to resemble the *Nautili*, *Litula*, and *Spirula* genera; but it has peculiarly distinct characteristics, and merits the honour of constituting a genus.

ICICA (Aublet). A genus of South American trees belonging to *Decandriæ*, and to the order *Terebinthaceæ*. Generic character: calyx four-cleft persisting; petals broad at the base, seated below the germen; spreading stamens inserted into the bottom of the calyx, under a circular disk; filaments shorter than the corolla; anthers oval, erect, and two-celled; style short; stigma two-headed; drupe two-valved; nut double. The fruit of one of these trees is very fragrant, and used as a perfume. The wood of *I. altissima* is very durable, and used for making household furniture, boats, &c.: as stove plants they succeed with the ordinary management.

IGUANA. A genus of saurian reptile, and the one which is perhaps most generally characteristic of those animals which are known by the general name of lizards, though Cuvier makes it the name of his third family, *Sauria*. The iguanæ, properly so called form the second section of the family, and are distinguished from the first family by having teeth on the palate. The general characters are: the body and the tail covered with small imbricated scales; a range or crest along the back, consisting of spines, or of scales, which are erected, compressed, and pointed; under the throat there is an appendage of skin, forming a sort of ruff in that part, the edges of which are supported by a cartilaginous production of the os hyoides; their thighs have a range of tubercles, like those on the true lizards; each jaw is furnished with one row of teeth, which are compressed, triangular, and trenchant; and there are besides two rows of small teeth on the posterior margin of the palate. There are several species, and as is the case throughout almost the whole class of reptiles, there is not a little confusion about the history of at least some of them. Those which strictly belong to the genus are, we believe, all inhabitants of the American continent, and chiefly of the tropical part of it, though some are found, at least, as far north as the southern parts of the United States.

COMMON IGUANA (*I. tuberculata*). This species is found in tropical America, especially in Guiana, and the countries westward to the shores of the Pacific; it grows to a large size, being in general three feet long, and specimens measuring five feet are not rare. The shape of the animal is not considered very handsome, in consequence of the prejudice which exists against the whole race of saurian reptiles, which are all very harmless creatures, with the exception of the larger ones which inhabit the waters; the upper part is greenish yellow, marbled with pure green, and having the tail annulated with brown; but the colours are variable, according to the position of the light, and the state of excitement in the animal, being blue, violet, green, and even black; the under part is of the same colour with the upper, but much paler; there is a crest of large spiny scales all down the back; a large plate on each side of the head, at the angle of the jaws; the sides of the neck are covered with pyramidal scales more thinly set than the rest; and the margin of the enlargement, or colour under the throat, is furnished with the same kind of scales as those on the ridge of the back. This species is very common in all the warmer parts of America; and it is not only very inoffensive, but of

considerable value to the inhabitants. It is generally found among, or upon, the branches of trees, but it occasionally takes to the water. It is understood to be in a great measure, if not wholly, vegetable in its feeding, living upon fruits, seeds, and leaves. The females lay a great number of eggs, which they deposit in the sand to be hatched. These eggs are about the same size as those of the pigeon; but, as is the case with the eggs of most reptiles, the two ends are alike in form. These eggs are accounted a great delicacy, and eagerly sought after on that account. The flesh is held in nearly equal esteem; and in consequence of this the animal is very much hunted. It is difficult to kill, which is a very common property of reptiles; and its skin is not easily pierced by a musket bullet, because if it strike obliquely, it glances off. When attacked, they assume a formidable, though not a dangerous aspect; they open their mouths, vibrate their tongues with rapid motion, inflate their throats, and erect their crests, while their eyes glance with the brilliancy of live coals. All this, however, is a demonstration for defence, and not for attack; for though they possibly may add insects to their vegetable food, there is no reason to suppose that they attack any animal of even the most moderate size. It very often happens, indeed, that the attitude of the iguana, and the peculiar sound which it gives, when alarmed by its enemies in the woods, both warn man of the danger to which he is exposed, and betray themselves to him as a prize.

SMOOTH-NECKED IGUANA (*I. nudicollis*). This species resembles the last-described in many respects, but it wants the large plates on the cheeks, and the pyramidal scales on the sides of the neck. The upper part of the head is covered with convex plates, the occiput is tuberculated, and the collar is smaller than the one last mentioned, and has only a few tubercles on the anterior margin. Some describers have represented this species as being a native of the east as well as of the west; but that is a mistake, for it occurs in no country except tropical America, and the West India Islands.

HORNED IGUANA (*I. cornuta*). This resembles both of the preceding in most of its characters; but it is distinguished by an ossious point of bone which stands up between the eyes, and is the part from which the animal gets the incorrect name of horned. There are two projecting scales also in the nostrils, but there is no plate on the cheek, and no tubercles on the neck. The scales along the edges of the jaws are, however, furnished with an elevated boss in the middle of each. This species is found in the West India islands, and especially in the island of St. Domingo. Its food consists of vegetable substances, insects, and small birds. The negroes hunt it with great avidity for the sake of its flesh; and the maroon dogs, or blood-hounds, of the country, which used to be so cruelly employed against the oppressed people of that and some other of the islands, are now employed in hunting the horned iguana. It is a day animal, and while the light continues, it follows its prey with wonderful assiduity; but during the night, it remains concealed in the holes of the rocks. During the rainy season it retires, and becomes nearly, if not altogether, dormant.

CAROLINA IGUANA (*I. Aychlura*). This species is found further to the north, and, like the last-mentioned one, it passes the inclement season in a state of repose. It has no large plate on the cheek, nor spines

on the neck; but the plates on the tail form a sort of armour, from which the animal gets the trivial name. It does not appear to differ much from the others in its manners.

BLUE IGUANA (*I. cærulea*) is wholly of a violet blue colour on the upper part, and the same colour, but smaller, on the under. In size, it is considerably less than any of the former, and the scales which form the dorsal crest, or ridge, are much less produced. In other respects, it scarcely differs from the rest; and therefore Cuvier is probably right in regarding it as only a coloured variety. There is not indeed a great deal of difference between the species of iguana, and there is a similar correspondence in their manners.

Many other saurian reptiles, besides those which we have enumerated, have been described as iguanas; but there are sources of error connected with the lizard, against which it is not easy to guard, at least on the part of those who take museum specimens as the foundation of their arrangements, because lizards change very much after they are dead, and the bodies of many are tender and easily mutilated.

ILEX (Linnæus). A fine useful genus of evergreen trees and shrubs, commonly known by the name holly. See **HOLLY**. They belong to the fourth class of Linnæus, and to the natural order *Celastrineæ*. Europe is the native clime of the common holly, but there are various species found in many other parts of the world.

ILLICIUM (Linnæus). A genus of Chinese and American evergreen and deciduous shrubs, belonging to *Polyandria Polygynia*, and to the natural order *Magnoliaceæ*. Generic character: calyx from three to six sepaled, deciduous, sepals unequal; petals nine, or more unequal; stamens inserted into the receptacle; filament very short; anthers erect, oblong, and emargined; style very short; stigma lateral oblong; capsules several, disposed in a circle, leathery, opening at top, and containing each one seed.

The plants of this genus are called aniseed-trees, from their fine aromatic scent. The dried capsules are called *five-fingers* in China, and in commerce *Chinese anise*. When the plant grows naturally, the capsules are used as a condiment, and chewed after dinner as a sweetener of the breath. The bark, when finely powdered, is used by the public watchmen in Japan to make a timekeeper, or instrument for measuring the hours, in order to direct when the public bells are to sound. The *I. anisatum* is a favourite and rather hardy greenhouse plant, grows well in loam and moor-earth, and may be propagated by cuttings.

IMPATIENS (Rivinus). A genus of curious annuals. These plants are natives of many different parts of the world. The flowers are pentandrious, and the genus ranks among the *Balsamineæ*. The plants have received their generic name from the elastic properties of their capsules, to scatter the seeds on being touched. One of them indigenous in England is called *Noli me tangere*, or Touch-me-not. They were formerly associated with the balsams.

IMPERATA (Cyrilla). A genus of plants belonging to the *Gramineæ*, with elegant feather-like spikes of flowers. Its strong reeds are used for many purposes in the south of Europe.

INDIAN BAY. This plant is the *Laurus Indica* of Linnæus.

INDIAN CORN is the *Zea mays* of Linnæus. This is a most important species of corn in America, and other countries suitable to its production. Some of the hardier varieties have been tried in this country, and, by some farmers who attended to its culture, with considerable success. But although the produce is great, both in grain and straw, it is not equal, all things considered, in value to our common horse bean, and certainly not to be compared with our common wheat as a bread corn. It has been so long known in our gardens, and is now so frequently seen in our fields, that any detailed account of the plant is unnecessary.

INDIAN CRESS is the *Tropæolum majus* of Linnæus, a well-known ornamental plant, cultivated not only for the beauty of its flowers, but for its seed-pods as a pickle.

INDIAN FIG is the *Opuntia ficus indica* of Haworth.

INDIGOFERA (Linnæus). A genus of herbs and shrubs belonging to *Diadelphia*, and to the natural order *Leguminosæ*. The *I. tinctoria* is the plant whence the valuable dye is extracted, on which account it is extensively cultivated in India, and other parts of the world.

In the Delta of the Ganges, where the best and largest quantity of indigo is produced, the plant lasts only for a single season, being destroyed by the periodical inundations; but in the dry, central, or western provinces, it lasts two years, one, or even two, offset crops being obtained; and owing to this circumstance, the planters in the latter situations are enabled to furnish a large supply of seed to those in the former. The seeds are sown in drills, a foot apart, during the rainy season, and kept free from weeds. In two or three months the crop is fit for cutting, but the plants must not be allowed to flower, otherwise the foliage becomes hard and unproductive; and it should be cut in wet weather, for if the season be too dry the stools will not spring again; hence from these and other circumstances, the produce is precarious. When cut, the herb is steeped in vats; and after being well macerated, and the colouring matter extracted, the liquor is drawn off into other vessels, in which it undergoes the peculiar process of beating, to cause the fæcula to subside. The fæcula is subsequently collected, and transferred into a third set of vats, where it remains for some time before it is strained through cloth bags, and evaporated in shallow wooden boxes placed in the shade. Before it is perfectly dry, it is cut into small pieces an inch square, and is then packed in barrels, or sewed up in sacks for sale.

It appears pretty certain that the culture of the indigo plant, and the preparation of the dye, have been common in India from a very remote period. Pliny mentions it under the name of *Indicum*, and states that, when diluted with water, it produces an admirable mixture of blue and purple colours. He knew, also, it was the produce of a vegetable, but was much mistaken as to its mode of preparation. The indigo plant, in its natural state, is innoxious; but indigo, when prepared, is a dangerous poison. The chemical changes which take place during the process of preparation, are extremely curious. Two or three species of this genus are kept in our stoves, and are easily propagated by cuttings.

INFEROBRANCHIATA, in modern malacology, is the fourth order of De Blainville's system; it

includes all such molluscs as have branchial organs of respiration, lamellarly disposed beneath the salient edge of the mantle; the body is always naked, oval shaped, and more or less tuberculated. This order merely contains the genera *Phyllidia* and *Linguilla*.

INGA (Plumier). An extensive genus of evergreen shrubs and trees, chiefly natives of South America, belonging to the natural order *Leguminosæ*. Generic character: flowers polygamous; calyx five-toothed; corolla of five petals, or parts; stamens united at the base, and protruding; style simple; pod compressed, two-valved, seeds pulpy or farinaceous. The genus has been separated from *Mimosa* to which it bears a resemblance, and may be treated in the same way as the stove mimosas.

INOCARPUS (Forster). A fruit-tree, common on the islands of the South Sea; hence called the Otaheite chestnut. It belongs to the natural order *Sapotææ*, is kept in our stoves, and propagated by cuttings.

INOCERAMUS (Brogniart). A mollusc only known in a fossil state; of course the animal is totally unknown; in its general appearance it resembles the *Ostracææ*, but more nearly the genus *Gryphæa*. Three species are enumerated by De France.

INSECT. The ordinary English name given to the individuals composing the most extensive class of animals to which Linnæus and the older authors gave the name *Insecta*, a word derived from the Latin, and signifying an animal cut or divided into numerous parts or segments, and equally applicable to various species which have the chief divisions of the body connected together by slender points of attachment; the legs in like manner are inserted or composed of various articulations. It is not surprising that these characters should have attracted the notice of the earliest naturalists, and we accordingly find the group of insects established by the first writers upon zoology; not indeed with that precision of definition which the anatomical researches of modern authors have enabled us to apply to the group, but, on the contrary, united with many other small invertebrated animals, which, even in the present day, are considered as insects by ignorant persons. On examining the body of an insect, we find it externally covered with a strong scaly coating, which, when internally examined, is found to give support to the muscles and other organs, thus becoming as it were an external vertebra; but the observation will immediately occur that the horny nature of this external covering must necessarily prevent the growth of the animal; and this would certainly be the case were not the difficulty obviated in a manner as remarkable as it is perfect, namely by the periodical shedding of the external envelope, forced open as it were from time to time by the internal organs, which have increased in volume since the preceding moulting, owing to the quantity of food taken by the creature. This shedding of the covering of the body is very variable in its effects upon the various groups of insects, in some consisting of a mere throwing off of the outer envelope, without any other change being effected, save that of an increase of size; in others, however, an increase of limbs is obtained; and in some, an entire change in the form of the body is effected, and organs of flight acquired. These latter changes are termed metamorphoses or transformations, and are more especially applicable to the winged groups of insects. Another important character distinguishing this tribe of animals is to be

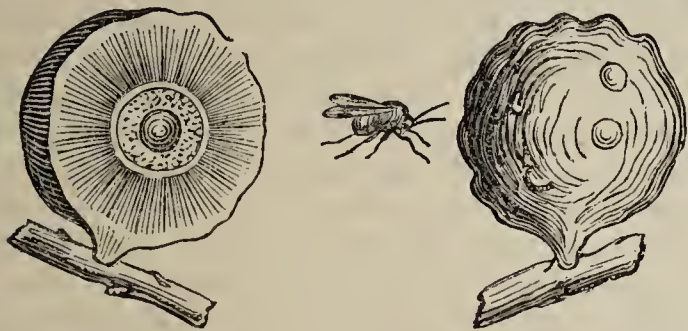
found in the highly organised structure of the eyes in the majority, although in some the organs of sight consist only in a number of small tubercular lenses, which are moreover found in some species which also possess the compound or faceted eyes. The head is also furnished, in the majority of the tribe, with a pair of articulated organs, varying infinitely in their construction, termed antennæ, of which the precise uses have not hitherto been decidedly ascertained. Such are the leading characters of the great mass of animals to which Linnæus gave the name of *Insecta*, but which Latreille has changed into *Condylopa*, from the articulated structure of the legs. The anatomical investigations of foreign naturalists, about the commencement of the present century, threw a great light upon the real nature of the various groups of Linnæan insects, and upon the respective value of the characters by which the orders into which they had been divided were separated from each other. It was thence at once discovered, that, although the winged orders of insects established by Linnæus were nearly allied amongst themselves, the wingless order (*Aptera*) contained a mass of objects having the most discordant organisations, and which, when properly examined, were proved to be characteristic of groups of higher rank even than the winged orders themselves. In this manner the apterous Linnæan genera, *Cancer*, *Monoculus*, and *Oniscus*, were formed into the class *Crustacea*; *Aranea*, *Scorpio*, *Phalangium*, and *Acarus*, into that of *Arachnida*; whilst *Scolopendra* and *Julus*, as a group named *Myriapoda*, *Lepisma* and *Podura*, under the name of *Thysanura*, and *Pediculus* under that of *Anoplura*, have been alternately raised to the rank of classes, or regarded as orders in the classes *Arachnida* and winged insects, to which last it has been proposed to restrict the name of insects. But this is a step to which we would strenuously object. We would not willingly be charged with veneration for the works of our predecessors in science merely because they happen to be old; but we do object to the spirit of innovation which cannot distinguish between what is old and what is good; and if the Linnæan group of insects is to be retained, as we submit that it ought to be, as one of the chief divisions of animals, we would certainly retain for it the name of *Insecta*, which so peculiarly refers to the great character of the group, in preference to that of *Condylopa* proposed by Latreille. It may indeed be said that it is not proper to apply the name of insect to a crab or a lobster, but they are as strictly insected animals as a bee or a beetle; and it may be said, that if we apply the name in this general manner we shall need some other name to distinguish the true winged insects from the *Crustacea* and *Arachnida*, and this it must be admitted is the fact; and the question then arises shall we, in order to obviate this difficulty, throw ourselves into the other dilemma, and take away the name of *Insecta* from insected animals. We, however, see no occasion for this step. Systematically, the winged insects may be named *Ptilota*, as proposed by Aristotle, and the Linnæan insects will retain their name of *Insecta*, divisible into four classes, namely, the *Crustacea*, *Arachnida*, *Ametabola*, and *Ptilota*; the first two of which are treated upon under their respective heads, and may therefore be dismissed from our future consideration. The third is a class the limits of which have been by no means decided by entomologists, Dr. Leach placing in it only the hexapod lice (*Pediculi*), and the spring-tailed

insects (*Lepismæ* and *Poduræ*); whilst MacLeay has added thereto the *Myriapoda*, consisting of the two orders *Chilopoda* (*Scolopendræ*) and *Chilognatha* (*Iuli*), as well as certain vermes. It would occupy us too great a space to enter into the considerations requisite for the investigation of the correctness of these views. We shall therefore (having already treated upon the last named insects in their alphabetic order) now confine ourselves to the true metamorphic or winged insects, or the *Ptilota* of Aristotle. In our article ENTOMOLOGY we have entered into some general considerations, in order to prove that the study of this branch of zoology is attended with great interest, resulting from the countless tribes of insects, their various forms, singular instincts, &c. With the further view of enticing the reader to follow us in our necessary details of the structure of these tribes, we now propose to renew the subject, by laying before him a short notice of the benefits and injuries resulting from insects to mankind, in order to prove to him that these little creatures are not so insignificant as he might be induced to believe them to be, but are very capable of rendering themselves obnoxious to him, should he be disposed to consider them as not worthy of his attention, or, on the contrary, of being rendered highly beneficial.

Of all animals, insects are unquestionably the most obnoxious to mankind, either personally or from their attacks upon his property, their minute size ensuring them success in their assaults, and scarcely permitting the possibility of extirpation. On the other hand, the benefits which he experiences, either directly or indirectly, are scarcely less extensive. If we would, therefore, endeavour successfully to combat the former, it can evidently only be done by the acquisition of a knowledge of their habits in every state of their existence, and in this point of view the study of entomology becomes of the highest importance. Let us take, for instance, the turnip-fly, of which we have given an account in our article HALTICA, and here we find that all the numerous investigations of the committee of the Doncaster Agricultural Association proved useless, because the natural history of the insect itself was not ascertained. In like manner, it must be equally evident that the diffusion of similar knowledge, and more especially inquiries into the chemical properties of many insects hitherto considered useless, might be the means of adding considerably to the list of benefits conferred by insects on man.

Of winged insects very few species have hitherto been found serviceable as articles of food. It is true, that in the deserts of Asia and Africa, where the locusts acquire a large size, these insects are employed, when dried and preserved, as food. The writer has tasted locusts thus prepared, and has found them not unpalatable, but they are said to possess but very little nutritious quality, and to produce disease when too much is eaten. The larvæ or grubs of many large beetles are also devoured by the negroes of India and America; and even the luxurious Romans were exceedingly fond of a large fleshy grub, which they called *cossus*, and which is supposed to have been the larva of the goat moth (*cossus ligniperda*). In like manner, the white ants are devoured by the savages of Africa and America; whilst the great quantity of honey annually consumed in every quarter of the world is sufficient to prove that, in this point of view, insects are highly beneficial. It has also been re-

cently discovered, that the manna which, it will be remembered, served the Israelites for food during their passage through the Wilderness, is but the concreted juice of an Arabian tree (*Tamarix mannifera*), which is caused to flow by the puncture of a small species of *Coccus*, which the celebrated Prussian entomologist, Dr. Klug, has recently described and figured under the name of *Coccus maniparus* in his splendid work upon the insects of Arabia, and to whom the writer himself is indebted for specimens of this interesting insect. In medicine insects are also of great service. Of these the *Cantharis vesicatoria* is the most important, and of the properties of which an account will be found in our article CANTHARIDÆ. Numerous other species were formerly introduced into the Pharmacopœia, but they have gradually been disused. In a commercial point of view, silk, chermes and cochineal are some of the most important products. Of the former we shall give a detailed account in our article upon the SILKWORM; and of the latter a description has been published in our article COCCIDÆ. There are many other insects which construct silken cocoons, and emit various coloured dyes, and which it might be very serviceable to endeavour to introduce as well as the true silkworm of the *coccus cacti*. Gumlac also, wax and ink-galls, are insect productions of too great importance to be passed over without notice. But there are other classes of bene-



The Ink-gall insect, and the insect by which it is produced.

fits resulting from the relations of insects with other organised beings. These, although less directly affecting man, ought not to be overlooked in a general survey of the economy of nature. Suppose the race of insects to be entirely annihilated, and then observe the thousands of ills which would inevitably result from the putrefying masses of animal and vegetable productions, and which are now, as it were, reduced to their native elements solely by the interference of the insect tribes. The entire tribes of *Silpha*, *Necrophagi*, *Dermestes*, *Nitidulæ*, immediately fall upon the dead carcasses of animals, devouring the flesh, and accelerating the dissipation of the putrid mass, and these, assisted by myriads of flies, which deposit their eggs in the decomposing body in such immense numbers, succeed, in a very few days, in reducing the carcass to a mere skeleton. In like manner, the *Geotrupidæ*, *Histeridæ*, and many other insects, are equally serviceable (as we have already stated in our articles upon these groups) in disseminating the excrements of animals, and rendering them serviceable to the agriculturist; whilst the tribes of insects which feed upon decaying vegetable matter are even still more numerous. As serving for food to some of the higher animals, as fish, birds, some of the smaller mammalia, &c., insects are eminently serviceable in the scale of the creation. Amongst birds, the shrikes, and the genera *Sylvia*, *Motacilla*, *Anthus*, *Certhia*, *Muscicapa*, and *Hirundo*, as well as

the cuckoos and pies; and amongst quadrupeds, the genera *Stenops* and *Otolienus*, which feed upon grasshoppers, the bats, shrew, hedgehog, mole, and especially the genus *Myrmecophaga*, which derive their sole nutriment from insects. Many species of insects are equally serviceable in destroying other noxious insects. Of these the tribes of predaceous beetles, sandwasps, ants, dragon-flies, spiders, &c., are to be noticed, but more especially the larvæ of the ladybirds (*Syrphidæ*) and golden-eyed flies, which destroy myriads of plant lice. All these, however, yield to the *Ichneumonidæ*, which annually destroy more caterpillars than the whole tribes of insectivorous birds. We must refer to our article upon this family to show the almost universal dominion of these parasitic tribes. In the last place, we have to notice the great services rendered by insects in effecting the impregnation of plants, in many of which the position of the sexual organs is such, that, were it not for the intervention of insects, especially bees, butterflies, &c., which, whilst seeking food for their own nourishment, unconsciously perform a most important office, of which we have already, in our article CECDOMYIA, mentioned an instance; and in our article CYNIPIDÆ we have noticed the effect of insects in effecting the more rapid ripening of the fig, by the process termed caprification by the inhabitants of the Levant.

It is, however, necessary for us now to reverse the picture, and to observe, that if insects are capable of being serviceable to mankind, other species are not less injurious to him and his property. We will first notice such species as possess a direct influence against mankind. Of these the various species of lice, the flea, jigger, and the bed-bug, are pre-eminently obnoxious. Besides these, we are condemned to suffer from the occasional attacks of multitudes of other species, which at all hours of the day cease not their tormenting powers. Moreover, the hotter the climate and the period when the body requires the greatest portion of rest, the more numerous are the hordes of our insect enemies. The *Tabani*, *Stomoxes*, *Asili*, are all highly irritating; but all these yield to the gnat and the mosquito, which are sometimes so annoying and so numerous, that their victims have sunk under their attacks. There is also another little insect, which, in the autumn, is very annoying to persons who walk about the fields, and which is so minute that it escapes observation. It is called the harvest-bug, but is in reality one of the *Acaridæ*, of a red colour, its mode of attack being to insinuate itself into the flesh of the legs, where it causes an intolerable itching, and raises the most irritating sores. An analogous species inhabits the West Indies, where surgical operations are required to dislodge it, causing, if neglected, abscesses, gangrene, and even death. The name of *Scholechiasis* has been applied to a disease in which the larvæ of various species of insects are found in the human body, but these appear to be entirely accidental cases wherein these larvæ have been injected. A species of *Æstrus*, in like manner, has been found to be parasitic within the body of persons residing in the tropics, but this (although it has received the name of *Æstrus hominis*) we should be rather induced to regard also as an accidental locality selected by the insect, instead of its real habitat. There is another tribe of insect enemies whose attacks are not less annoying, although not resulting, like the former, from a desire to feed upon our bodies. Here are to be ranked the bees,

wasps, and other insects provided with poisonous stings, which, however, they seldom employ except in their own defence, or to resent injuries offered to themselves. Here also may be added the spiders, whose powerful jaws are equally provided with a poisonous fluid, as well as the scorpion, whose long and jointed tail is defended at the tip with a powerful sting. Other insects are to be ranked amongst our minor miseries, namely, such as, by the emission of a caustic, or disgusting fluid, operate strongly upon our olfactory nerves. But the tribes of insects which prey upon our cattle is equally numerous, including fleas of different species, ticks, gadflies, forest flies, and especially the remarkable family of *Æstrideous* flies, the larvæ of some of which are ordinarily termed bots. Of the latter we have already given an account in our article BOT. In like manner, our poultry and our bees are subject to the attacks of various insects, of some of which accounts will be found in our articles upon the DEATH'S-HEAD MOTH and the GALLERIA.

It is not, however, upon ourselves and living animals that the ravages of insects are confined, almost every species of property being in some measure or other liable to be injured by them. Our clothes, and other woollen productions, are devoured by the larvæ of various species of clothes' moths, which not only feed thereon, but also form for themselves coverings of the same materials; and the richest furs are subject to the attacks of a similar insect; whilst our museums are equally ravaged by the *Dermestes* and *Anthreni*. Our furniture is often completely destroyed by the timber-boring beetles and death-watches (*Anobium*); and some species of white ants, in warm climates, are so destructive in this respect, that if a chair or table be suffered to remain for a time in the same situation, the interior substance will be completely consumed, nothing remaining but the outside shell, which the insect has the instinct to leave entire. The last named insects may indeed be regarded as amongst the most destructive of our insect enemies, since they scarcely leave any article untouched. Ants also are, in warm climates, almost as destructive; and even in our own country, one of the smallest species of ants, *Formica unifasciata*, has increased to such an extent in certain parts of London, and some other towns, devouring all kinds of articles, that the inhabitants have been compelled to quit their abodes.

Our provisions are also not less liable to the attacks of insects; bread and flour are devoured by the blattæ and meal-worms, and we have seen ship-biscuit swarming to such a degree with the grubs of a species of *Anobium* as to be worse than useless. The *Dermestes* feed upon our dried meats. Cheese is attacked by mites; and the cheese-fly, the grubs of which are termed cheese-hoppers, from their singular motions which we have already described in our account of this insect. Our granaries are ravaged by the corn weevil and by the larvæ of a species of *tinea*; but if we turn our attention to the species of insects which attack such living vegetable productions as are most gratifying to the lip of mankind, we find the catalogue woefully augmented.

We need scarcely mention the locust as being the most redoubtable of our insect enemies in this respect, although, fortunately for our country, their ravages are here unknown, except by description. Our wheat whilst in blossom suffers from the attacks of the Hessian fly and *Cecidomya tribici*, of which we have

already given an account, whilst its roots are devoured by the larvæ of the *Zabrus gibbus*, which sometimes, as in the year 1812, near Halle in Germany, is produced in such numbers, that whole corn fields are entirely destroyed. The larvæ of some of the *Elateridæ*, known by the ordinary name of wire-worms, also attack its roots, as well as the roots of various other garden plants and culinary vegetables. The grubs of the cockchaffer in like manner often do much injury by devouring the roots of grass, as do also those of the *Tipulæ*. Of the former, an instance is recorded by Kirby and Spence, in which all the fields of a farmer near Norwich were entirely destroyed, and as many as eighty bushels were collected by him and his men. Various other esculent roots are also devoured by the larvæ of other insects; amongst which the damage occasioned by the onion-fly (*Anthomyia ceparum*), the grub of which destroys the plant when still very young, is, perhaps, the most detrimental. In like manner the stems and the pith of trees and plants are equally subject to the ravages of insects, amongst which may especially be noticed the *Bostrichidæ*, of whose proceedings under the bark of trees we have already given a detailed account. The gigantic larvæ of the longicorn beetles, goat-moths, *Siricidæ*, &c., are not less destructive by boring through the solid wood of various trees; whilst an ant (*Formica saccharivora*), which takes up its abode in the stem of the sugar-cane, has proved at certain periods in the highest degree obnoxious. But it is upon the leaves and young buds and stems of plants that insects are the most detrimental in their attacks. Of these the turnip-fly, *Haltica nemorum*, and some other species hold the foremost rank. Entire and extensive families of beetles (*Crioceridæ*, *Chrysomelidæ*, &c.), are similarly employed in devouring the leaves of various plants, as well as the numerous species of saw-flies; but it is amongst the *Lepidoptera* that this species of injury occurs in the highest degree, whole forests being sometimes entirely defoliated by various species. In like manner the flowers and fruits of various plants are subject to similar devastation by insects. It would, however, require an entire enumeration of vegetables and their attendant species of insects, in order to lay before the reader a complete account of the ravages of insects upon our vegetable productions; since it is to be observed that, for the most part, the latter are destined by an all-wise Creator for the support of the former. Their ravages, therefore, which man regards as injuries towards himself, are but the natural result of the ordinary workings of the economy of nature. A few observations upon this branch of the subject, and with reference to the employment of remedies against the attacks of these noxious insects, will not be considered out of place. One of the most common, and at the same time most weighty charges brought against the entomologist is, that whilst he bestows endless labour and trouble in collecting and preserving the various species of insects, his attention is never, or but very rarely, directed to inquiries into the most effectual remedies against those insect scourges which nature has inflicted upon our vegetable productions. He is told over and over again, that to make the science which he cultivates more beneficial to society, and thereby more generally known, a share, at least, of his attention must be occupied in prosecuting experiments for the purpose of discovering how this or that insect enemy may be combated in the most suc-

cessful manner. And, indeed, it must be admitted, that this is a charge too well founded, although, perhaps, a few observations may convince those who are the most ready to bring it forward upon every opportunity, that it may be greatly palliated. In the first place, therefore, it may be urged, that these destructive insects, appearing as they do in occasional seasons in vast profusion, are produced in such myriads for some wise purpose, which we may not be permitted to understand. They, like the locusts, of which so splendid a poetical description is recorded in the second chapter of the prophet Joel, form a portion of the army of the Almighty wherewith he scourges the nations; and, although the scientific researches of mankind might discover means of destroying in some degree, these hosts, it may perhaps not unreasonably be supposed either that he would not be allowed to frustrate the designs of Providence, or that, if this evil were removed, others perhaps more weighty might arise in their stead. In the second place, the minuteness of the size of these creatures presents an almost insurmountable barrier against those delicate inquiries and examinations of them, during every state of their existence, by which alone we can arrive at a knowledge of the real nature and cause of the mischief, and be thereby, and thereby alone, enabled to judge of a suitable remedy. In the third place, the want of sufficient opportunity is not the least objection which may be brought against the charge. It must be admitted, that no effectual check can be given to the ravages of any species of noxious insect until its entire habits and economy have been ascertained. Thus far in the inquiry is the strict province of the entomologist, whose attention ought to be directed from day to day, and from year to year, not to isolated spots of ground, but to whole acres, more especially with reference to the peculiarities of seasons, and to atmospheric changes; but here we have only gone halfway. It now becomes the province of the agriculturist to discover a remedy, since it seems equally clear that this ulterior branch of the inquiry can only be prosecuted effectually by persons perfectly conversant with the chemical nature of soils, the action of various ingredients which may be employed as remedies, not only upon insects themselves, but also upon the plants which may be attacked. Such persons too are alone able to judge of the practicability of the application of the proposed remedies, since it would be useless for an indoor entomologist to endeavour by experiment to discover remedies which, when discovered, cannot be adopted from the great expense of the article itself, or the impossibility of applying it, or the liability of the destruction not only of the insect, but also of the plant itself, and even instances of the latter description have been recorded.

Hence we must evidently look for the discovery of the most efficient remedies to persons who, residing in the country, are the best enabled to obtain a knowledge of the economy of these destructive insects, founded upon the most general and practical modes of examination, and who unite the entomological knowledge requisite to trace most effectually their habits, with a perfect and scientific knowledge of the true principles of agriculture. Thus it seems undoubted, that this want of sufficient opportunity for investigation has hitherto proved one of the greatest barriers to our proposing satisfactory remedies against the ravages; and knowing, as we too well know, that

the study and investigation of this branch of zoology has hitherto been almost uncultivated amongst us, it is not, perhaps, surprising that so little has been done. The observer of insects has, indeed, proposed remedies which the agriculturist cannot adopt; and the agriculturist on the other hand, ignorant of the nature of insects, has pursued the very plan which has been the most congenial to the habits of the insects which he wished to destroy; as in the case of the French gardener, mentioned by Reaumur, who thinking to destroy the caterpillars of the cabbage-moth, buried them just at the time when they were themselves on the point of going into the earth to change to chrysalides*.

Thus have we endeavoured to show not only that in respect to their various relations towards mankind insects possess considerable claims upon our attention, but have also been anxious to prove that a knowledge of the habits and economy of insects in their various states, cannot fail to be highly advantageous, and, in fact, absolutely necessary, both in order to enable us to discover suitable remedies against the attacks of obnoxious species upon ourselves or our properties, and also as tending to the probable discovery of other species equally beneficial with those already employed by man. It therefore now becomes necessary for us to detail such particulars relative to the various stages in the lives of insects to which we have already alluded, as are essential to be known, in order to obtain a correct notion of their habits in these various states.

We have already stated that the subjects of our present inquiry, as restricted by the establishment of the other modern classes separated from the Linnæan insects, comprise those species of annulose animals, which are provided in their perfect state with six jointed legs and two antennæ, and which are subject to a series of transformations of a variable degree, by means of which, in almost every species, organs of flight are developed; the latter characters constituting, in fact, the grand characteristic of the class *Ptilota*, or winged insects. Hence it will be evident, that an inquiry into the nature of these changes, and a consideration of the peculiarities exhibited by insects during their progress towards maturity, constitute the first step, and are, in fact, the necessary commencement of our inquiries into the nature of insects.

There are, it is true, inquiries of a preliminary nature, having reference to the entire sub-kingdom of annulose animals; such, for instance, as the question of typical priority of the various classes, the points of connection existing between them, and the other animal sub-kingdoms; the supposed uniformity in the organization of the various parts of the mouth, so ingeniously and elaborately worked out by Savigny, Latreille, &c., or the attempts made by various authors to reduce their varying structure to one typical form. These inquiries, however, which are the especial province of the comparative anatomist, would occupy too great a space in an essay like the present, and could not, in fact, be treated in a satisfactory manner, or even be rendered intelligible to the general reader, without an elaborate series of figures and descriptions. Hence we must refer our readers to the works of these authors, and more particularly to the work of M. Straus Dürckheim, upon the general

* From the Magazine of Natural History.

principles of the comparative structure of annulose animals. Leaving, therefore, these abstruse but highly interesting and philosophical topics, our present inquiry will be directed in tracing the insect through its various stages; first, to a general consideration of the principles which regulate the metamorphoses of insects; and secondly, to a review of the peculiarities exhibited by these animals, in their passage to the perfect state. To these will naturally succeed, thirdly, a general view of the insect structure, especially as exhibited in such perfect state, both externally and internally; fourthly, a sketch of their physiological and instinctive properties; and we shall terminate our inquiries by, fifthly, a sketch of the classification of the winged insects.

Section I.—*On the principles which regulate the metamorphoses of insects.* One of the most remarkable peculiarities connected with the progressive development of animals, is that for the discovery of which we are indebted to the physiological researches of modern comparative anatomists; namely, that animals traverse through a certain series of grades of development, by means of which they ascend from the first simple beginnings of life to its highest perfection; these various grades being evident representatives, or analogies of the perfect states of the still more inferior types of animals. This singular and startling peculiarity is not a fanciful theory, but has been the result of the most accurate application of the facts, obtained by the aid of comparative anatomy. And the consequent result of this principle is, that the higher the animal in the chain of creation, the greater number of grades has it to traverse. Not that by this assertion it is intended that one animal was, at any period of its existence, a distinct animal, but simply that certain types of form, or various peculiarities of certain internal organisations, which are characteristic of the perfect state of the more inferior animals, are reproduced in those of a higher rank, previous to the arrival of the latter at the precise type which is their own. “No one,” observes Burmeister, “who speaks of the embryo of man passing through the lower grades of the animal kingdom, can have imagined that man, at any period of his embryo life, was ever an infusory animal—polypus, muscle, snail, worm, crab, spider, insect, fish, turtle, snake, lizard, and bird; but the assertion is nothing more than that man has once, in the progress of his development, been upon that grade upon which the several classes beneath him remain stationary, in the progressive development of the entire animal kingdom.” Now, the most general form of insects is that of an articulated elongated body; but previous to its bursting into life, whilst yet in the egg, its organisation represents that of the most inferior animals, having then no other organs than those of nutrition; when this release is effected, we find the animal has now ascended to the lowest types of the articulated structure; the earthworm and the leech are strictly represented by those vermiform grubs which have no distinct head, and which belong to the order of two-winged flies, *Diptera*. Will it, we ask, be asserted, that this is but a fanciful idea, confirmed, as it is, by the fact, that the dipterous insects, when arrived at the perfect state, are the least perfectly developed of all the winged insects. Another grade is attained by those larvæ, which, although vermiform, are furnished with a distinct head, as the larvæ of the *Hymenoptera*,

which represent the water *Nais*; a third grade is exhibited in those larvæ which have the body furnished with lateral gills, and reside in tubes; and a still higher is reached by those larvæ which, like the *Nereis* and *Aphrodita*, belonging to the *Annelida*, have a distinct head and legs on the under side of the body. In the following or pupa state, we find some pupæ, as those of the gnats, breathing like the crustacea, by gills; others, as those of the moths, buried under ground, like the *Myriapoda*; whilst the pupæ of butterflies are suspended like the *Arachnida*, in the open air. The above, which is a brief abstract of the analogies exhibited by Dr. Burmeister, do not, it must be admitted, in some respects possess equally strong grounds for adoption; but the view of the subject is so novel, that much necessarily remains to be discovered; and what has yet been adduced, can only be regarded as an approximation towards the truth; neither can this view of the subject be fully confirmed, until by the aid of comparative anatomy, and by an accurate investigation of the nervous and other systems of animals, the rank of each principal division in the scale of creation has been definitely settled. Still, however, sufficient has been advanced to prove that this view of the subject corroborates the principle already alluded to, that it is owing to the development of wings that the *Ptilota*, or winged insects, are necessarily subjected to a more complete and astonishing series of transformations, than the other annulose animals, in which the changes (to which, in fact, in a greater or less degree, all animals are subject) consist in a periodical casting off of the outer envelope. It is true, that in a few insects, which are evident exceptions to the general rules, this same mode of moulting takes place; and it is also to be observed, that during a certain and early period of their existence the same principle exists throughout the winged tribes of insects which, in such cases, represent in their imperfect state the perfect state of the other *Annulosa*. We have already said, that, owing to the external envelope of annulose animals constituting their skeleton, and offering from its stronger consistence a complete obstacle to the increase in size of the enclosed animal, it was necessary that this skeleton should, from time to time, be cast; we have, however, still to inquire, how the animal which throws off so important a portion of its organs as its skeleton, can exist, or in what manner a new skeleton is formed. Swammerdam, in his really wonderful series of observations, discovered, in his endeavours to prove that all insects were produced from eggs, and that the caterpillar was but an immature butterfly, that, shortly previous to changing to a chrysalis, the various parts of the butterfly were found distinctly encased beneath the skin of the caterpillar. And therefore he has raised the theory which has been generally adopted by subsequent authors, that every caterpillar, at its first exclusion, contains within itself the germe of the future butterfly, and of all its envelopes, which, successively presenting themselves, are thrown off, till it attains its perfect winged state. This theory has, however, been completely opposed by Dr. Herold, a distinguished microscopic observer, who, from a most elaborate, indeed, we may affirm, the most elaborate investigation of the kind, hitherto made, upon the cabbage-butterfly in its various states, has arrived at the contrary conclusion—that the successive skins of the caterpillar, the pupa case, &c., do not

pre-exist as germes, but are formed successively from the *rete mucosum*, which itself is formed anew upon every change of skin; these formations being attributable to the action of a power which he terms the *vis formatrix*.

Against the latter theory, Messrs. Kirby and Spence have raised various objections, none of which appear to the author of this article to be of sufficient weight to overthrow it in favour of the old theory of Swammerdam. The first of these objections is, that Dr. Herold employs the high-sounding term, *vis formatrix*, to conceal his own ignorance of causes, when endeavouring to penetrate within the *sanctum sanctorum*, which is not permitted to vain man to enter—a plan adopted in all ages, and instanced in the adoption of such words as *Plastic Nature*, *Epigenesis*, *Panspermia*, *Idea seminalis*, *Nisus formativus*, &c. It is evident from these observations, that these authors would endeavour to fix upon Dr. Herold a charge of infidelity, in supposing that the structure of an insect possessed of itself a power to mould itself according to its own formative will and power. And this is evident, because in a subsequent page they adduce the fact, with which every physiologist is acquainted, that the developments and acquisition of new parts and organs, by insects undergoing metamorphoses, have taken place according to a *law*, which regulates their numbers, kinds, and times, since the first creation. But surely they are not authorised by Dr. Herold's views and statements, in wielding against him this powerful (if maintainable) argument, since it must be evident, that by the term *vis formatrix*, Dr. Herold meant not to imply any power independent of the Creator, but simply that principle of development which, under the guidance of an Almighty hand, is constantly in operation, not only in insects, but in every other branch of the creation*. It would be as unjust to assert, if a man, whose finger had just healed from a wound, and who should thereupon say that he had gained a fresh layer of skin by the action of his flesh, that he was an atheist. But in the next place, Messrs. Kirby and Spence do not deny the facts stated by Dr. Herold, that the organs of the butterfly are not discernible in the larva, but gradually become visible, as the caterpillar throws off its successive coverings. They assert, indeed, that they can easily comprehend that pre-existent germes, by the constant secretion of new matter, in a proper state, may be gradually developed; but find it impossible to conceive how, by the action of second causes, without the intervention of the first cause, the *butterfly should be formed in the caterpillar*, unless it pre-exists there as a germe or foetus. The question is not, however, whether the butterfly be or be not inclosed as a foetus within the caterpillar; but whether, as Swammerdam evidently intended, the various skins of the caterpillar, &c. existed as distinct and visible germes within the newly-hatched caterpillar; and this Messrs. Kirby and Spence endeavour to support, by the argument which they adduce from Bonnet, that "organs that have no existence as to us, exist as they respect the embryo, and perform their essential functions; the term of their becoming visible, is that which has

been erroneously mistaken for the period of their existence."

The question, therefore, now assumes a new form. It is not, as between Swammerdam (contending that the successive skins of the caterpillar exist as distinct and visible germes in the newly born caterpillar,) and Dr. Herold (asserting that these skins are successively produced from the *rete mucosum*), but simply whether we are to consider with Kirby and Spence, that these germes are pre-existent, though not perceivable even by the application of the most powerful microscope, but which subsequently, "by the constant accretion of new matter in a proper state, are gradually developed;" or with Dr. Herold, that they do not pre-exist as germes, but are successively formed from the *rete mucosum*. Having, however, divested the arguments of the latter from the charge of atheism which has been attempted to be forced upon them, we really are not prepared to consider that there are no grounds for the adoption of the latter in preference to the former. It is true that Dr. Herold discovered the organs of sex in the newly excluded larva; but these and other organs of the perfect butterfly, are those which, from their very nature, must be regarded as requiring the greatest and most gradual degrees of development; but the case is quite different with such temporary organs as the skins of the caterpillar: but let us look to facts,—Messrs. Kirby and Spence are unable to adduce any in support of the existence of invisible germes, but according to Dr. Herold, there is not the least trace in the young larva of the new skin, but this first originates towards the end of the first period of the caterpillar's life, a few days only before the old one is stripped off. It is then observed that the mucous and muscular layers of the skin separate all round, from the epidermis, and then clothe themselves upon the superior surface with a new epidermis. The development of this new external skin occupies two or three days, during which the caterpillar appears sickly, and takes but little nourishment; the old skin then splits longitudinally along the back, and the caterpillar emancipates itself from its old envelope by drawing out the body. The epidermis, all the external visible organs, and even the mandibles and palpi, remain attached to the old skin. This moulting is repeated several times.

Various physiologists, and especially Dr. Virey, have endeavoured to trace an analogy between the transformations of insects and the development of some of the higher animals; attributing, as Mr. Mac Leay observes in his *Horæ Entomologicæ*, the metamorphoses of insects to the shedding of an envelope analogous to that which contains the foetus of the more perfect vertebrata. And as every embryo, whether animal or vegetable, is inclosed in a tunic more or less solid (its chorion), so proceeding with the analogy, they conceive there must be some condition for every animal, similar to the state of the foetus of the more perfect animals, when surrounded by the amnios of this state, and which in the hexapod insects, they hold to be the larva, according to which the true birth of the animal will be its exclusion from the pupa case. This argument seems to have been derived from an observation of Reaumur—namely, that the larva of insects ought to be regarded as an egg of an extraordinary kind, endowed with organs of locomotion and nutrition; and that this analogy is also retained during the period of the insect's existence in

* It is rather remarkable, that Messrs. Kirby and Spence, after having thus endeavoured to brand Dr. Herold as an atheist, should have expressed a supposition, that the skins of serpents are formed under the old skin, from the *rete mucosum*, (Vol. III. p. 191.) The *vis formatrix* of Dr. Herold, is of no higher rank than the power implied in this expression.

the chrysalis state. When we consider, however, that many species of insects are active in the pupa state, and that on their exclusion therefrom they have acquired their full size, and are fitted for the reproduction of their species, we must admit that the former view of the subject is scarcely maintainable; and that the larva state, which is especially that in which the digestive system predominates, and the greatest supply of food is taken, is more strictly analogous to the period of infancy of the higher animals.

We are now to examine,

Section 2.—*The peculiarities exhibited by insects in their passage to the perfect state.* Perhaps none of the phenomena of natural history have attracted a greater share of the attention of mankind in all ages, than those exhibited by insects in their passage to the perfect state. It is perfectly consistent with that innate propensity of the human mind towards the marvellous, that the change of a caterpillar into a butterfly should have been considered by the ancients as a true metamorphosis, in no manner reconcileable with the ordinary process of nature. If this were indeed the case in the darker days of zoological knowledge, when the true nature of these changes was not understood, it is equally certain that the subject has lost none of its interest, although, owing to the admirable researches of Libavius and Redi, Malpighi and Swammerdam, Reaumur and De Geer, all of the marvellous has been removed, and a series of gradual developments exposed far exceeding in peculiarity those exhibited in any of the other tribes of animals.

But it is not alone in elucidating the nature of the changes, by means of which a caterpillar becomes a butterfly, that the researches of these authors are most valuable; since this discovery naturally led to the equally important truth that the caterpillar is produced from a creature which has at one period of its existence resembled itself; and which, having arrived at its perfect state, and been impregnated, has perpetuated its species by the deposition of eggs, which, when hatched, produce small voracious animals of variable forms, ordinarily termed caterpillars, grubs, or maggots, and systematically larvæ (plural of the Latin word larva), liable to a series of moultings, varying in number. To this state in the majority of insects, succeeds a quiescent period, during which the appearance of the creature is completely altered. The insect in this state is termed a chrysalis, or aurelia, and more generally and technically a pupa (plural, pupæ). After remaining in this state a certain period, the insect again throws off its covering, and appears in its perfect form. It is now termed a beetle, butterfly, bee, &c., according to its kind, but technically and generally the term imago is applied, to designate the adult state of all insects. These terms, larva, pupa and imago, were employed by Linnæus, whose nomenclature was often fanciful, although generally applicable; the first, in allusion to the *larvated*, or *masked* appearance of the insect whilst a larva; the second, from the resemblance of the insect, during the pupa state, to the mummy-like appearance of children wrapt up in swaddling clothes; and the third, because having laid aside its mask, and cast off its swaddling clothes, it is now in its perfect state, and has become a true representation or image of its species. Hence the four stages of an insect's existence are the egg, larva, pupa, and imago.

It is true, however, that, as we have already

shown in our articles APHIDES and BLOWFLY, the eggs, but very rarely, are hatched within the body of the parent fly, and deposited as larvæ; and that, in the *Hippoboscidae*, the larva even undergoes its change to the pupa state previous to being deposited by the parent; but still these insects have originated from eggs; and it is also true, that in some groups the insect in the pupa state is active, and differs only from the larva in having small tubercular rudiments of wings upon the back (as in the orders *Hemiptera* and *Orthoptera*); and in the apterous individuals of these orders it is next to impossible to assert whether an individual be in the larva, pupa, or imago state. These are, however, but exceptions to the general rule, and do not warrant the opinion maintained in an ingenious paper published by Mr. Newman in the *Entomological Magazine*, to which we would refer the reader; namely, that insects have but three stages of existence, the foetal, the adolescent, and the adult, inasmuch as in the majority of insects, the last is preceded by a distinct but variable state, which we have above noticed as that of the pupa. In like manner, we see no sufficient grounds for rejecting the terms larva and pupa, and employing such terms as infancy and adolescence in their stead. Indeed, the setting aside of words employed in a technical sense, and universally understood, merely because they may happen to be in a foreign tongue, or may, even in their origin, have been somewhat fanciful, appears to us to savour somewhat of affectation, or even something worse than this, when the perfectly quiescent and apparently lifeless state of an insect is regarded as analogous to the adolescence of the higher animals.

Our present inquiry, therefore, resolves itself into four distinct heads—namely, the egg, larva, pupa, and imago.

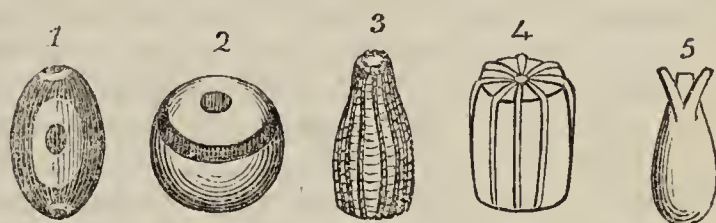
1. *The Egg.*—We have already seen in the present article, as well as in various others of our entomological articles, that there is no ground for the popular idea that any kind of insect is produced otherwise than from eggs deposited by a parent. The first branch of our inquiry will therefore be devoted to the situation in which the eggs of insects are deposited, and the extraordinary instinct exhibited by the female in this operation, and which has been attributed to the influence of maternal affection. As, however, it happens that, in the great majority of instances, the female dies immediately after depositing, and long previous to the hatching of, her eggs; and as, moreover, it is erroneous to attribute such feelings as love or affection to animals so low in the scale of existence as insects, we would refer these proceedings to the operation of that indefinable influence which is ordinarily termed instinct. That this is a correct view of the matter, must be evident from a perusal of the details which we have furnished of the proceedings of the hive-bee and of the ants; where we have seen that insects incapable of reproduction (neters) are equally active in preparing nests, &c., as the real parent. This branch, therefore, of our inquiry, ought perhaps more correctly to come into our physiological view of insects, although it can hardly be said to be out of place here.

Insects, as regards the situations in which their eggs are deposited, may be divided into two classes; those which, with much labour, form a residence, and lay up a store of food for their progeny; and those which simply place them in situations where the young, when hatched, will be certain to find a due supply of food.

Of the former, the highest place must be accorded to those social insects which build nests of the most beautiful construction, serving not only for the education of their young (which are produced from eggs placed in separate cells), but also for the habitation of the entire community at large. We must refer to our articles upon the BEE (Hive-Bee), HUMBLE BEE, HORNET, WASPS, ANTS, and FORMICIDÆ, WHITE ANTS, TERMITIDÆ, &c., for many details which it would be useless to repeat. We are next to notice the sand-wasps, and many solitary species of wild bees and wasps, which construct their nests with great labour in the sand or in rotten wood, forming a succession of cells generally of an oval or rounded form, in which they deposit a supply of food either of pollen, paste, or other insects, sufficient for the nourishment of the larva when hatched from the egg, which is placed in the cell with this supply. We have already given instances of this mode of proceeding in the articles CERCERIS, FOSSORES, CERATINA, HALICTUS, &c. Here also may be ranked the dung-rolling and dung-boring beetles, whose history we have given under the articles GEOTRUPES and GYMNOPLURUS, as well as the burying-beetles (*Necrophagus*), whose exploits in burying small dead animals, in which they deposit their eggs, are not less indicative of a high degree of instinctive powers. The *Cicadæ* likewise, as well as the saw-flies, may also here be noticed, since the care with which the parent constructs a burrow in the stems of plants, for the reception of her eggs, by means of a most admirably constructed apparatus, is equally remarkable, although the larva, as soon as hatched, is compelled to seek elsewhere for its food, namely, the leaves on the adjoining twigs. But the instinct which is exhibited in the selection of appropriate situations for the eggs, and where the larva, when hatched, will find a supply of food, without the same being laid up in store by the parent fly, is found to be possessed by the greatest number of insects. Many species of larvæ will feed only upon one particular species of plant; and the parent fly, in its perfect state, takes no other food than a little honey from every flower which may be in bloom at the time; still it is only upon that particular plant which suits the taste of her progeny that she deposits her eggs. Here are to be ranked many of the tribes of lepidopterous insects (Butterflies and Moths). Many species of moths, as well as beetles, reside in the larva state under the bark of trees; the females, therefore, by means of a long and jointed ovipositor, are enabled to place their eggs at the bottom of the crevices in the external bark. In like manner, the carrion flies deposit their eggs upon carrion; the flesh-flies upon flesh; the flies whose larvæ feed upon plant-lice, in the midst of the plant-lice; and some species of these flies (*Hemerobius*) render the security of their young doubly secure, by placing their eggs out of danger at the extremity of long and slender foot-stalks (fig. 9). In like manner, the boat of eggs formed by the gnat (see our article CULICIDÆ), and the egg-pouch of the *Hydrous*, are alike deserving of notice. But it is amongst the parasitic insects that this species of instinct appears most fully developed. Of this we have already given numerous instances in our articles upon the CUCKOO-BEES, CHRYSIDIDÆ, CHALCIDIDÆ, and especially ICHNEUMONIDÆ; whilst the proceedings of the bot-flies, and the instinct whereby, as in the *Gasterophilus equi*, a particular spot upon the body of an animal is selected for the reception of the egg,

is most remarkable. It would, however, be an almost endless task to detail the various modes adopted by insects in order to deposit their eggs in such situations that their progeny may be sure of meeting with an ample supply of food.

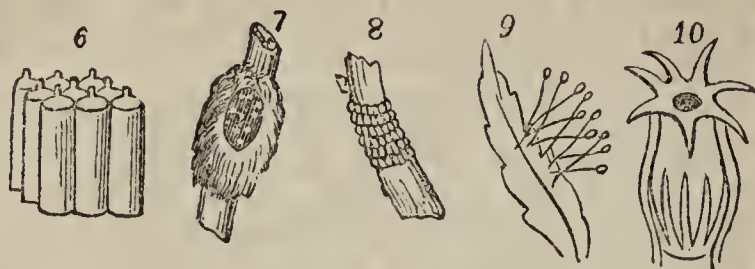
If the instinct exhibited by the parent fly be worthy of observation, the number of eggs which she deposits is not less interesting. Thus the queen bee produces from 40,000 to 50,000 eggs in the course of a year, and supposing a swarm to contain 32,256 individuals, and three swarms to take place in the season, the population of a hive would in a single year amount to nearly 100,000 bees; and the *Aleyrodes proletella*, a little homopterous insect, may give birth in a year to more than 200,000 young. A species of moth, according to Lyonnet, produces in the third generation more than a million of young; and the *Aphis*, observed by Reaumur and Bonnet, produced at the fifth generation 5,904,900,000 individuals, and there may be not less than twenty generations in the course of a year. The female white ant, whose enormously distended body causes her to exceed her companions many hundred times in size, deposits sixty eggs in a minute, which is at the rate of 211,449,600 in the course of a year. Other insects are, however, less prolific. The silkworm produces only from 400 to 500 eggs, the caddice flies less than 100; the burying beetles about thirty; and the horsefly (*Hippobosca equina*) can only be said to deposit a single egg.



The eggs of insects are generally of an oval form (fig. 1, oval-spotted egg of the fox-moth), the outer covering being sufficiently rigid to resist ordinary external impressions; others are, however, soft and pliant. In some species they are globose, as in many lepidoptera (fig. 2, globular-banded egg of the vapourer-moth); or conical, as in the large white cabbage butterfly (fig. 3); cylindrical, pear-shaped, barrel-shaped, &c. They are for the most part smooth; but many are very beautiful, ornamented with symmetrical ridges (figs. 3 and 4, egg of the tortoise-shell butterfly), canals, dots, &c., giving them, as Reaumur observed, the appearance of embossed buttons. There are numerous other varieties in the form of eggs, and some are furnished with appendages for peculiar purposes. Thus the egg of the dung-fly (*Scatophaga putris*, fig. 5) has two oblique props at one end to prevent it sinking too deep in the matter upon which it is deposited; whilst those of the water scorpion (*Nepa cinerea*, fig. 10) are furnished with a coronet of spines forming a receptacle for the egg, which is deposited immediately afterwards.

The colour of insects' eggs varies very considerably, although white, yellow, and green are the more prevalent tints; orange, red, brown, and black, with all the intermediate shades, are to be found, as well as blue; and others are banded with pale circles, and that of the pine lappet moths is blue with three brown zones. The colours of eggs are, however, subject to change as the inclosed larva approaches the period of its escape, this being owing chiefly to the change of

colour undergone by the latter being visible through the slender coating of the egg.



In many species the eggs are deposited singly; in others, however, they are discharged *en masse*, of which latter, the most remarkable instance occurs in the cock roaches (*Blattæ*), of which we have already given an account. Others again arrange them symmetrically (as in the cylindrical pointed eggs of the *Sembris lutea*, fig. 6), and others enclose them in a mass of gluten, especially those species which inhabit the water in the larva state; many species employ a gummy matter to attach them firmly to the substances on which they are placed; whilst some (as the yellow-tail moth, *Arctia chrysorrhæa*) wrap them in a coating of down (fig. 7), which they pull off their own bodies by the assistance of an apparatus fitted for that purpose; and the lackey moth (*Lasiocampa Neustria*) deposits her eggs in a spiral coil round the stems of fruit-trees (fig. 8).

The period which elapses between the deposition of the egg and the birth of the larva depends upon the temperature of the atmosphere, as well as upon the species of insect. Thus, whilst the early laid eggs of the tortoise-shell butterfly hatch in a few days, those which are not laid till autumn will not produce caterpillars until spring. The eggs of the meatfly hatch in a very few days, or even hours; eight days are required by the eggs of the painted lady butterfly; whilst the caterpillars of the machaon butterfly are not hatched under a month. It is, however, a general rule, that those eggs which are deposited in the autumn are not hatched until the following spring.

The investigation of the development of the grub whilst inclosed within the egg is attended with so much difficulty, owing to the minuteness of the objects, that hitherto but little progress has been made in this branch of the subject. Dr. Herold, however, whose admirable microscopic observations we have already noticed, has taken it up; and the first part of his magnificent work entitled "*Disquisitiones Animalium Vertebris carentibus in ovo Formatione*," has recently appeared, and will tend to throw much light upon this intricate subject. One peculiarity ought not to be omitted relative to this part of our subject, namely, that the eggs of the sawflies, gallflies, and ants, increase very considerably in their size, and alter in form previous to the exclusion of the larva, and which is doubtless owing to the membranous covering of the egg and to the growth of the inclosed larvæ. In general, the embryo caterpillar is observed coiled up within the egg, the head being brought into contact with the tail.

We have said that the majority of insects die previous to the birth of their progeny, but this is not the case with the whole. Thus De Geer ascertained that a large species of field-bug (*Pentatoma grisea*) survives this event, and that she leads her brood about, consisting of from thirty to forty young ones, in the same way as a hen does her chickens. Some-

what similar observations have been made upon the common earwig by De Geer, as well as by the author of "*Insect Transformations*," who has published the following interesting notice in the Penny Magazine: "About the end of March I found an earwig brooding over her eggs in a small cell scooped out in a garden border, and in order to observe her proceedings, I removed the eggs into my study, placing them upon fresh earth under a bell-glass. The careful mother soon scooped out a fresh cell, and collected the scattered eggs with great care to the little nest, placing herself over them, not so much, as it afterwards appeared, to keep them warm, as to prevent the too rapid evaporation of their moisture. When the earth began to dry up she dug the cell gradually deeper, till at length she got almost out of view; and whenever the interior became too dry, she withdrew the eggs from the cell altogether, and placed them round the rim of the glass, where some of the evaporated moisture had condensed: upon observing this, I dropped some water into the abandoned cell, and the mother soon afterwards replaced her eggs there. When the water which had dropped had nearly evaporated, I moistened the outside of the earth opposite the bottom of the cell, and the mother perceiving this, actually dug a gallery right through to the spot where she found the best supply of moisture. Having neglected to moisten the earth for some days, it again became dry, and there was none even round the rim of the glass as before. Under these circumstances, the mother earwig found a little remaining moisture quite under the clod of earth, upon the board of the mantel-piece, and thither she forthwith carried her eggs. The subsequent proceedings were not less interesting; for though I carefully moistened the earth every day, she regularly changed the situation of the eggs morning and evening, placing them in the original cell at night, and on the board under the clod during the day, as if she understood the evaporation to be so great when the sun was up, that her eggs might be left too dry before night. I regret to add, that during my absence the glass had been moved and the mother escaped, having carried away all her eggs but one or two, which soon shrivelled up." De Geer was more fortunate, and as we have ourselves repeatedly observed, noticed the care of the female in defending her young when hatched.

There are other insects whose attention is devoted to the care of the eggs and the education of the young, especially in the social species. When the period is arrived for the hatching of the egg, the enclosed larva bursts through the envelope, either by main force or by gnawing through it with its jaws. Sometimes, however, one end of the egg is provided with a sort of cap, which is easily pushed open.

The Larva.—The insect has now arrived at an active state of existence; it is now that it is destined, in a more especial manner, to grow and to eat. It is to this state that the ordinary terms caterpillar, grub, and maggot are generally applied in a manner so indefinitely, that it is impossible, with any pretension to correctness, to assign these terms to any precise divisions of insects. In general, insects at this period of their lives appear in the form of a cylindrical ringed and fleshy worm, provided generally with a distinct head and six scaly legs attached to the anterior part of the body. The head, however, in some species is not distinct, and the legs are sometimes

wanting; whilst in others the terminal segments are furnished with membranous (false or pro)-legs. In other species, however (the number of which is but comparatively small), the insect nearly resembles its parents, being, however, destitute of wings. This variation naturally introduces two principal divisions amongst insects, the former being said to have a complete metamorphosis, and the latter an incomplete one; but as these terms have also been employed by Linnæus and Fabricius in a more restricted and totally different sense, and as they have been applied to designate the entire metamorphosis, instead of simply indicating the formation of the larva, we prefer dividing insects, from a consideration of their larvæ, into two divisions, which may thence be named *Heteromorpha* and *Homomorpha*.

In all this diversity, however, there is still a general prevailing uniformity of structure, which, under various modifications of form, preserves a tendency towards one typical organisation. This typicality in larvæ consists in having the body ordinarily composed of thirteen segments, which are for the most part of an equal size, although when arrived at maturity, some of these segments become obsolete, being converted into internal organs, or are greatly altered as regards the extent of their individual development. Here the entire object of the animal's existence consists in its capability of feeding; consequently, owing to the formation of the internal digestive organs, the body maintains throughout its various segments a general conformity, none requiring an extra development for the support of organs fitted for other purposes. When, however, the insect has arrived at the perfect state, its objects are completely altered, it has now to seek its mate; it is therefore provided with wings, which requiring support from the segments to which they are attached, cause these segments to be necessarily developed in an extraordinary degree; the other adjacent segments being losers: the insect has also now to perform the great object of its existence, namely, the continuing of its kind, and therefore the organs of generation become organs of especial importance, and we accordingly find other portions of the body sacrificed for their development.

The thirteen segments which compose the body of the larva bear the following relation to the distribution of the segments in the imago. The first segment or head of the larva becomes the head of the imago; the three following segments compose the thorax, and the remainder become the abdomen in the perfect insect. Dr. Ratzeburg has, indeed, lately published a memoir, endeavouring to prove that the two first segments of the larva of the aculeate *Hymenoptera* become the head of the imago; but the observations of this author, as we have proved more than once, are incorrect, and founded upon very unphilosophical views.

In the *Homomorphous* division, the larvæ greatly resemble the perfect insect, differing chiefly in being entirely destitute of any appearance of the organs of flight. The second segment of the body also does not exhibit the shield-like scutellum which is found in the imago in that situation; here belong the various tribes of locusts, grasshoppers, and crickets (fig. 11, larva of the cricket), bugs (fig. 12, larva of a *Pentatoma*), tree and frog-hoppers, cockroaches, preying mantes, &c., constituting the orders, *Orthoptera*, *Hemiptera*, and *Homoptera*, as well as some portions the order *Neuroptera*. Some of these insects are,

however, remarkable for being destitute of wings in the perfect state, and a difficulty thence arises of distinguishing the larvæ from the subsequent states. The variation in their size, and the constant absence of ocelli, as well as a somewhat less perfectly developed organisation of the antennæ; these, and some other parts of their structure, may serve to distinguish them. From analogy with the higher animals, we might, perhaps, be induced to consider that these insects which maintain a constant activity throughout their existence, are much higher in the scale of nature than those species which, like the butterfly, are subject to so long a period of death-like repose.

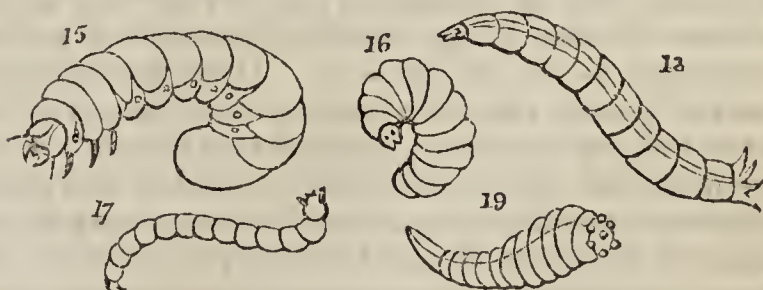


In the *Heteromorphous* division the larva is totally unlike the perfect insect, being generally more or less vermiform, and, with the exception of the head, of a leathery-like texture. Here belong the tribes of beetles, butterflies, moths, bees, and most other four and two-winged flies, as well as the flea. There are, however, various modifications of form in respect to the head and legs of the larvæ of those insects, so that it may, perhaps, be advisable to give a sketch of their distribution, proceeding from the more fully to the less perfectly developed species.

A. *Larvæ capitatae*, or those having a distinct head, sub-divisible into

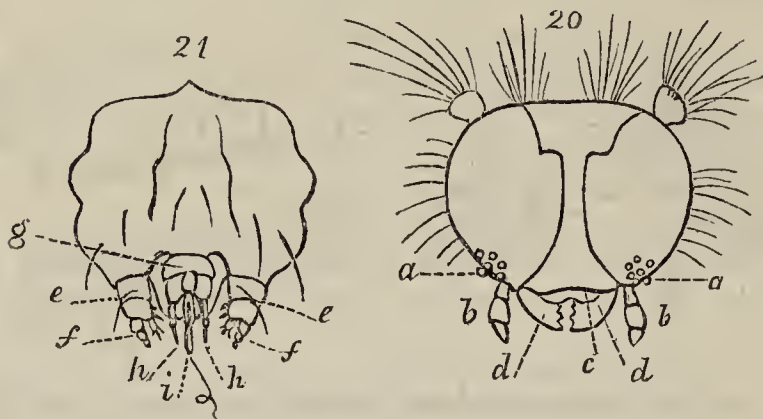
1. *Hyperhexapodæ*, or those having six legs, and a variable number of membranous prolegs. The larvæ of butterflies (fig. 14, larva of Camberwell beauty butterfly), moths and saw-flies (fig. 13, larva of *Cimbex lutea*).
2. *Hexapodæ*, or those having six scaly legs, but being destitute of prolegs. The larvæ of many *Coleoptera* (fig. 15, larva of *Trichius nobilis*), and some *Neuroptera*.
3. *Apodæ*, or those destitute of legs and prolegs. Many *Coleoptera*, *Hymenoptera* (fig. 16, larva of wild bee), gnats and tipulæ (fig. 18, larva of *Tipula*), and the flea (fig. 17, larva).

B. *Larvæ ecapitatae*, or those without a distinct scaly head, including the majority of dipterous insects (fig. 19, larva of the flesh fly), some few of which are furnished with membranous tubercles serving as prolegs.



The head, in the generality of larvæ, is covered with a corneous case, often divided by an impressed line running down the middle of the face, into two

lateral lobes ; its form is more or less rounded, but it often assumes a triangular or heart-shape ; occasionally, as in the caterpillars of some butterflies, the two lobes are terminated by spines or tubercles. There are other variations in the appendages by which this part of the body is distinguished. In the second section above described, the head is generally retractile, membranous, and variable in form, and destitute of eyes and antennæ, as well as of the ordinary parts of the mouth, which appears only to consist of a pair of hooks, or bristles, which are incapable of either cutting or grinding ; the insect employs them not only to pierce the soft matters, upon the juice of which it feeds, but also as claws whilst engaged in locomotion.



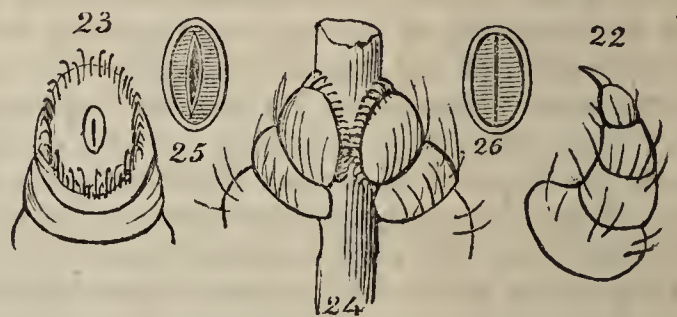
The *head* of larvæ is generally provided with a pair of short rudimental antennæ, eyes, and organs of the mouth.

The *antennæ* (fig. 20, *b*) are placed near the base of the mandibles ; they are for the most part totally unlike the antennæ of the perfect insect, although in the homomorphous section they are very similar in this respect, although shorter, and composed of fewer joints. These organs are, however, in general very short, and composed of three or four joints ; and in many groups they are entirely wanting in the larva state.

The *eyes* of larvæ are not, like those of the perfect insect, formed of an innumerable series of hexagonal lenses, but consist of a small number of simple granular tubercles, placed at the sides of the head, in the same situation that the eyes of the future insect are to be developed ; they are, therefore, more analogous to the simple eyelets of many insects which we shall subsequently describe under the name of ocelli ; many larvæ are, however, entirely destitute of them. Their numbers, when present, seldom exceed six on each side, which is the number possessed by the caterpillars of butterflies (fig. 20, *a*). The larvæ of the dragon flies have eyes somewhat resembling those of the perfect insect.

The *mouth* of the majority of larvæ consists, like the mouth of the perfect insect, of an upper lip (fig. 20, *c*), a pair of horny jaws (fig. 20, *d*), a second or lower pair of jaws of less firm consistence (fig. 21, *e*), furnished with an articulated palpus (fig. 21, *f*), and a lower lip (fig. 21, *g*), furnished also with a pair of articulated palpi (fig. 21, *h h*). Here, however, we have to remark that the structure of the mouth of the larva will, by no means, lead us to a correct idea of the mouth of the imago ; thus the jaws of the caterpillars of butterflies are as robust, and not very unlike those of the larvæ of beetles ; but the mouth of the former consists of a slender spiral and tubular apparatus for sucking up honey, whilst that of the latter retains much of the general appearance of the mouth of the larva. There are some peculiarities in the

structure of various organs of the mouth, which it may be interesting to notice. Thus the jaws of the antlion fly, and of the predaceous water beetles, are very long, slender, curved, and sickle-shaped, having a small longitudinal aperture near the extremity, which communicates with an internal canal, through which the juices of the prey of the insect pass. Another remarkable peculiarity exists in the elongated elbowed structure of the lower lip of the larvæ of the *libellulidæ* (dragon-flies), which we have already described, and which is employed like an arm furnished with claws for seizing their prey. Again, in those larvæ which spin for themselves silken cocoons, in which they undergo their transformations, the lower lip is furnished at its extremity with a minute and slender organ (fig. 21, *i*), which Kirby and Spence have aptly termed the spinneret (*fusulus*), composed of several longitudinal slips alternately corneous and membranous, whereby the insect has the means of contracting the tube, which terminates in a single orifice, and through which the insect emits its silken threads, which, although elaborated in two distinct silk tubes, unite previous to their emission from the orifice of the tube. Some larvæ, indeed, spin a silken thread for the formation of cocoons from a distinct apparatus at the extremity of the body.



We now pass to the description of the other segments of the *body* of larvæ, and the organs of motion, and other appendages with which they are provided. Generally speaking, these segments, which are typically twelve in number, are of a cylindrical and elongated form ; but various modifications occur, some larvæ being flattened, others oval, some short and thick, others having the segments very irregular, warty, spinose, or hirsute. The three anterior segments are, however, ordinarily distinguished by each having on its inferior surface a pair of short scaly legs, composed of four or five joints, which are analogous to those of which the legs of the perfect insect are composed, and generally terminated by a small claw (fig. 22). In many larvæ, as we have indicated in the table given above, these are the only legs with which the insect is furnished, although it rarely occurs that these are wanting, the organs of motion being the merely rudimental prolegs. These prolegs are thick, and of a membranous construction, so that, unlike the true articulated legs which are capable of motion only at the articulations of the joints, these are completely flexible. These legs are exclusively adapted to the insect whilst it remains in the larva state, there being nothing at all analogous to them on their arrival at the perfect state. These legs are furnished at the extremity with a multitude of minute bent hooks, which are employed by the larva in retaining its situation, upon whatever substance it may happen to be placed, with very great firmness (fig. 23 and 24). These prolegs are very variable both in their structure and situation, as also in their number, varying from two to eighteen. These

variations afford grounds for classifications of the larvæ, but which it would be tedious to detail without entering more fully into minute particulars than our space will allow. In like manner the various horns, spines, and protuberances must be passed over in silence, especially as we have already in our article CATERPILLAR, and upon various other occasions, noticed any remarkable variations which may occur in those respects. It remains, however, to be noticed, that the terminal segment of the body is often very different from the preceding in its form, and that its underside in some hexapod larvæ is furnished with a retractile tubercle, which the insect sometimes employs as a seventh leg.

In addition to the organs above described, are to be noticed the spiracles, or apertures by which the larvæ take in a supply of air. These spiracles are not, as in the higher animals, situated in the head, but are arranged in a series on each side of the body, opening into two longitudinal tubular internal vessels called tracheæ, from which an immense number of ramifications diverge to every part of the body of the insect. These spiracles are placed in the first, fourth, and following segments (except the last), and consist of a small elongated opening surrounded by a callous margin (fig. 25 represents a spiracle open, and 26 a closed spiracle). In aquatic larvæ, however, a variation in the organization of the animal necessarily takes place, as it is not exposed to the ordinary action of the air. We have seen already in our article DYTICIDÆ and DRAGON-FLY, how this is effected in these insects; but in other aquatic larvæ, as in the EPHEMERÆ, the sides of the body are furnished with elongated flattened plates, through which a slender air tube meanders, and which communicates with the longitudinal air tubes above-mentioned. (fig. 32.) Other variations occur in the larvæ of the gnats (*Culicidæ*) and midges (*Chironomus*), which we have already described. But the most curious variation which occurs in this respect, is found in the very common larvæ of the *Helophius pendulus*, which has been termed the rat-tailed grub, from the peculiar formation of the extremity of the body, which is very slender and elongated, enclosing a second still more slender air tube, which is capable of being protruded, so as to be pushed to twelve times the entire length of the body. As the insect lives in mud, this structure is eminently serviceable in enabling it to obtain a due supply of air.

There are, however, some considerations resulting from the variations in the form of the larvæ of insects which ought not to be passed over without notice, inasmuch as the subject is one of great interest, hitherto but little cultivated, and one of much importance as regards the classification of the annulose sub-kingdom. We have already observed that the immature state of insects typified the perfect forms of those particular grades through which the winged type may be supposed to have passed in its progress to maturity. Without arriving at this theory as stated above, Mr. MacLeay, in his *Horæ Entomologicæ*, and Messrs. Kirby and Spence, have given a series of analogies exhibited by the larvæ of insects with other annulose groups; the former contending that it is only by the assistance of such analogies that the real mode of distribution (by which every variation shall have its due weight appropriated to it), and the consequent discovery of the natural system, can be attained; thus the larvæ of the cockchafer, and other lamellicorn beetles, represent a full-grown Iulus in its peculiar

mode of rolling itself into a coil on one side; and the same analogy is exhibited by the larvæ of the sawflies. It would lead us too far to enter more at length into these views which, however, it would have been improper to have entirely overlooked.

We have said that it is during the larva state that the chief supply of nutriment is taken by the larva. It will be proper, therefore, that we should enter into a few particulars relative to the voracity of insects at this period of their existence, and which, in proportion to their size, far exceeds that which is exhibited by any of the larger animals. Thus Redi discovered that the larvæ of the flesh fly had become, in the space of twenty-four hours, at least two hundred times heavier than before. And the Count Dandolo gives the following as the result of the most exact calculations made from the observations of the cultivators of silk, who know the exact weight of the leaves devoured by the caterpillars; 1609½ pounds weight of leaves being consumed by the progeny raised from an ounce weight of eggs.

First age,	6 lbs. of sorted leaves,	1½ lbs. refuse	
Second age,	18	3	„
Third age,	60	9	„
Fourth age,	180	27	„
Fifth age,	1098	102	„
		105 allowed for evaporation	
	1362	+	247½ = 1609½ lbs.
Deduct further allowance for litter, uneaten leaves, &c.	155½		
			1206½ lbs. actually devoured.

But it is to be observed, however, that the stomachs of these insects, like that of the horse (see HORSE), does not possess the power of dissolving these leaves in the most perfect manner, but only of extracting a juice from them. Indeed this very circumstance is assigned by John Hunter (*Observations on the Animal Economy*, page 221, quoted by Kirby and Spence) as the probable proximate cause for the voracity of herbivorous larvæ. And hence, of the 1206½ pounds of leaves actually devoured, 745 pounds are deposited as excrement in an indigested state. Hence it is evident that in comparison with the stomach of the perfect insect, in which state but very little food is in general taken, and in some cases the insect is even totally destitute of a mouth, the stomach of the caterpillar, and its apparatus for taking its food, must be fully developed; and this is found to be the case, the stomach occupying a considerable portion of its interior, and the organs of the mouth being very robust. The caterpillar of the goat moth is three years in arriving at its full size, when it is 72,000 times heavier than when newly hatched; and a silk-worm, weighing when first hatched 1-100th part of a grain, consumes in thirty days about 60,000 times its primitive weight.

These particulars may suffice for the voracious powers of individual insects. It is when they have been produced in considerable numbers together that these powers are rendered more widely perceptible; and in fact become highly prejudicial, as we have already endeavoured to shew in the early part of this ARTICLE. An instance or two may not, however, be here out of place. Of these, the first we shall mention is the salt-marsh caterpillar of North America, of which an interesting account has been published

by Dr. T. W. Harris, in the Massachusetts Agricultural Repository. This insect is the caterpillar of a moth allied to our ermine spot moths, being the *Arctia acris* of Fabricius. It is very hairy, somewhat like the caterpillar of the garden tyger-moth, and is endued with a great degree of vitality, for long immersion in water does not destroy life. Being often exposed to that element, they seem provided with the power of enduring its approaches. They feed twice in the day, about ten o'clock in the morning, and four in the afternoon. If overtaken by the tide while feeding, they mount to the top of the grass, and then, if obliged to relinquish their hold, contracting themselves into a circular form, they commit themselves to the water. By this means they are washed to the borders of the marsh, where they are left by the wash of the sea in heaps, but alive, and in a short time ready to re-commence their depredations upon the meadows. The hair upon their bodies seems to possess a repelling power, which secures the spiracles from the admission or access of the water, for were this to be the case, the insect would be drowned. Their most favourite food is the onion grass, which is very succulent; but they are not fastidious, and eat with avidity 'fox' and 'bottom grass,' and even 'thatch' and 'sedge.' By the first of August these caterpillars have attained their greatest size; they now become very voracious, and continue eating all the day and night without intermission, by which means the hay crops are greatly detrimented. Soon they leave the meadows aggregated in great numbers, and commence their wandering state, or 'begin to run', as is the phrase, devouring every thing in their progress. Corn-fields, gardens, and even the coarse and rank produce of road sides, afford them temporary nourishment, until they have found a place of security against the tide and weather. Another moth, belonging to the same group, of whose proceedings an account was published in 1782, by Mr. W. Curtis, under the name of the brown-tail moth, *Porthesia auriflua*, is occasionally not less numerous nor injurious in our own country. In the year above mentioned, so vast were their numbers, that the trees were despoiled of their foliage; and it was feared that they would extirpate the growing corn and grass, and starve the cattle to death in the fields. They were regarded as the harbingers of the plague, and prayers were ordered to be read in all the churches, to avert the supposed impending calamity. In France, also, the same, or nearly-allied species has so frequently appeared in such prodigious numbers, to the defoliation of the forests, that the legislature have promulgated several ordinances for their destruction.

The colours of larvæ are very variable; indeed it would be very difficult to lay down many general rules respecting them. It may, however, be observed that those species which are destitute of legs, and are of a fleshy consistence, have the body generally of a white, or dirty white colour. Many caterpillars also, which greatly resemble each other, produce moths totally unlike, whilst moths, which are so closely allied that it is almost impossible specifically to distinguish them (the shark moths, genus *Cucullia*, for instance), are different in their larvæ, which are consequently resorted to as affording a more certain specific character. Caterpillars also vary in their colours during their growth; and Mr. Sheppard has observed, that the skin of the caterpillar of the privet hawk moth, after being under ground four days, was changed

from a vivid green to a dull red. A similar change of colour also occurred in a caterpillar of the puss moth (*Cerura vinula*), which we endeavoured to preserve. From what has been said, it will be easily conceived that the colour of the caterpillar affords no criterion for judging of the colours of the future moth: the most beautifully coloured larvæ, as Reaumur observes (mem. l. page 198), producing the dullest coloured moths; and *vice versa*. De Geer has, however, given two instances in which the moth preserves the colours of the caterpillar; these are the magpie moth (*Abraxas grossulariatæ*, figured in our article ABRAXAS), and the green *Pyrallis prasina*. Dr. Harris, in his memoir upon the salt marsh caterpillar, also notices that there are two varieties of the moth corresponding with the caterpillars from which they are produced; from the dark caterpillar and brown cocoon proceeds a moth with ash-coloured wings, and from the lighter coloured larva and cocoon is disclosed a moth whose upper, and also sometimes the lower, wings are white, these colours not designating the sex. De Geer also observed that the brown caterpillars of the yellow underwing moth (*Triphaena pronuba*) produce males, and the green ones females.

Respecting the growth and size of larvæ, it is to be observed as a general rule, that they are longer and heavier than the perfect insect. According to the Count Dandolo, the following is a statement of the progressive increase in the weight of silkworms.

	Grains.
A hundred worms just hatched weigh about	1
After the first moulting	15
After the second moulting	94
After the third moulting	400
After the fourth moulting	1628
On attaining the largest size	9500

From what we have already advanced in our observations upon the principles of metamorphosis, it will readily be conceived that with this rapid growth a continued shedding of the skin must be required. Hence we find caterpillars are subject to a greater or less number of these changes of the skin. The great garden tyger-moth (*Arctia caja*) undergoing as many as ten such moultings, *Arctia dominula* nine, *Arctia villica* from five to eight. The ordinary number, however, appears to be three or four, although it would seem that the grub of the bee, and many other footless grubs, undergo no moulting, although both Reaumur and Swammerdam assert that the contrary is the case. We have already, in our observations upon the general principles of the metamorphoses, noticed the peculiarities which occur in the caterpillar immediately previous to and during its moulting. We may therefore add, in order to complete the subject, that, quitting its former skin, the caterpillar appears very languid, and its body is soft and easily injured; it speedily, however, resumes its strength, and has increased so much in size that it appears extraordinary how it could have been packed in its former covering; its wonted voracity returns, and it now feeds with redoubled energy, as if to make up for the time which it had lost.

In this manner, and for a certain period of time, the growth of the insect is continued. The period which is required for the arrival of the larva at its full size is very variable. Perhaps the most general rule is, that insects are annual in their generations; either being hatched in the spring from eggs deposited in the preceding autumn, and becoming chrysalides in

the course of the summer, and arriving at the perfect state in the autumn; or else passing the winter in the chrysalis state, and bursting forth as perfect insects in the spring, and then depositing eggs, the progeny of which will not require to undergo their change to pupæ until the autumn: the duration of the larva state of these latter will therefore necessarily be longer than in the former; but there are exceptions to these rules; thus, in many species there are many generations in a year, as in the *Aphides* and the flesh-flies; whilst, on the other hand, some larvæ, as those of the goat-moth and cockchafer, require three years before they attain their full growth, and the stag-beetle is stated by Rosel to extend to six years.

Having at length attained its full size, the larva is now to undergo a change more important than any to which it has hitherto been subject.

III.—*The Pupa.* The change to which we alluded at the close of our last section consists in another shedding of the outer skin, when the insect appears in a totally different form, during the period of which it is destined to remain in inactivity and liable to destruction, were it not for the admirable instinct which is exhibited by the larva before its change, in the construction of a case or cocoon, wherein it is safely lodged until its final assumption of the perfect state. We have already, in our article COCOON, given a general statement of the proceedings of the cocoon-forming caterpillars. There are also many larvæ which, although the pupæ are inactive, do not construct cocoons, but merely secrete themselves in some obscure situation, or bury themselves under ground, where they hollow out a narrow cave for their repose. Others again, as detailed in our article BUTTERFLY, suspend themselves in the open air. Another class, as described in our article DIPTERA, retain their larva skin within which they become pupæ. This period of inactivity is not, however, universal, since there are many insects which retain their activity, and therefore need no cocoon for their defence. This is the case with the grasshopper, cockroach, *Cimex*, *Cicada*, and others.

The state to which the insect is now arrived is technically termed the pupa; and it is this term which we must be compelled to make use of in speaking of the present state of insects, since there is no English word applicable to pupæ in general. The terms *Chrysalis* and *Aurelice* having indeed been applied to the pupæ of *Lepidoptera*, and that of nymph partially to other pupæ.

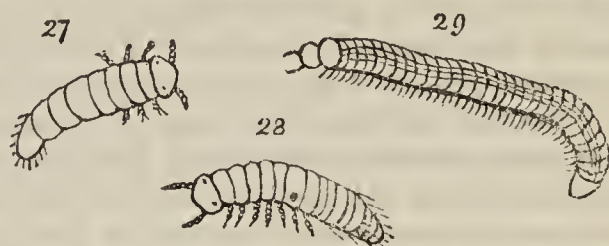
The variations which exist in the pupæ of the different groups of insects are much more striking than those observable in the larvæ; hence it is not surprising that Fabricius and his followers employed the name which characterises the pupa to designate the general nature of the metamorphosis, a decidedly incorrect mode of proceeding; since by this means the metamorphosis of an insect is said to be perfect when the pupa state is perfect (that is, active, and resembling the perfect insect, except in wanting wings); whereas it must be evident that this kind of metamorphosis must, as compared with other species, be the least perfect or complete; and, on the other hand, the imperfect metamorphosis, or that having the most imperfect pupa, must for the same reason be the most complete and perfect change which any of the insects undergo.

Linnaeus first applied these and similar terms, and most appropriately, to designate the variations, not of the nature of the metamorphosis, but of the pupa.

They were as follows:—

1. *Pupa completa*, active, with all the parts of the perfect insect. Example, *Aranea*, *Acarus*, *Oniscus*.
2. *Pupa semicompleta*, active, resembling the parent, but having only rudiments of wings. Example, *Gryllus*, *Cicada*, *Cimex*, *Libellula*, *Ephemera*.
3. *Pupa incompleta*, inactive, but with rudimental wings and legs. Example, *Apis*, *Formica*, *Tipula*.
4. *Pupa oblecta*, with the thorax and abdomen distinct, enclosed in a scaly covering, i. e., *corticata*, and either naked or enclosed in a cocoon. Example, *Lepidoptera*.
5. *Pupa coarctata*, enclosed within a globular or oval case, formed of the skin of the larva. Example, *Musca*, *Æstrus*.

Now the true winged insects necessarily suffer only the four latter species of metamorphosis; although in those species of the semicomplete kind, which have no wings in the perfect state, it may with equal propriety be said that they belong to the first section in which the pupa is complete; these, however, must be regarded only as exceptions, belonging in reality to the second and not to the first section. Latreille, to whom entomology is so much indebted, distinguishes three species of metamorphosis, to which, with a view to obviate the difficulties arising from the Fabrician mode of nomenclature, he has applied a different series of names, calling the first *Metamorphosis inchoata*, *dimidiata*, and *perfecta*. The first of these terms is applied to wingless insects, such as the *Scolopendra*, *Iuli*, &c., and in which the variations of the larva and pupa states are so indistinct that the terms cannot with propriety be employed, the metamorphosis consisting occasionally of an increase in the number of limbs and rings (figs. 27, 28, magnified; and 29,



natural size, representing the growth of an *Iulus*). In the species undergoing the metamorphosis *dimidiata*, the differences are more observable; the larva (demi-larva, Latreille) is apterous, but the pupa (demi-nymph, Latreille) is furnished with the rudiments of wings. This division, therefore, corresponds with the section *Pupa semi-completa* of Linnaeus, or the *Metamorphosis semi-completa* of Fabricius.

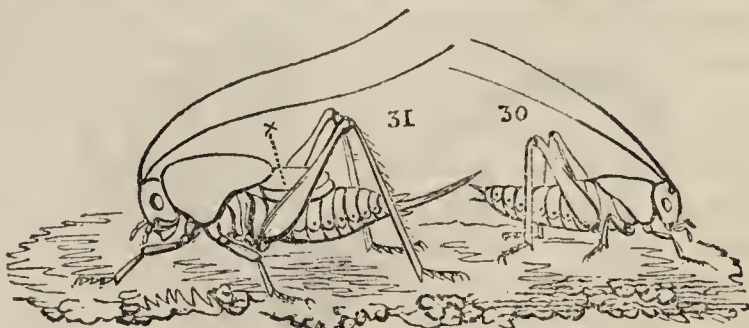
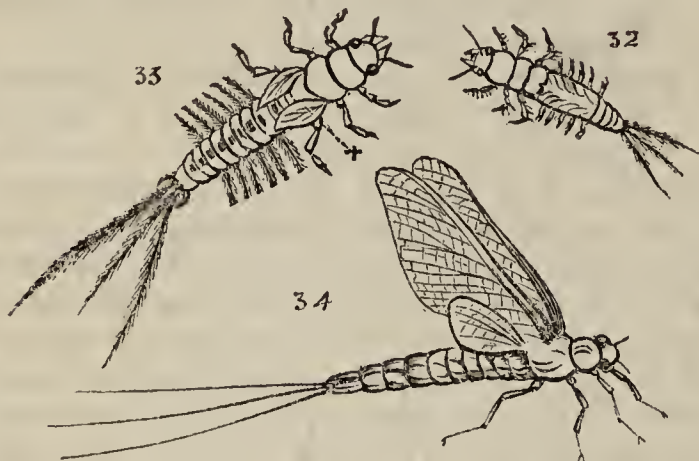


Fig. 30, Larva; 31, Pupa of the great green English grasshopper. See article GRASSHOPPER, for figure of its Imago.

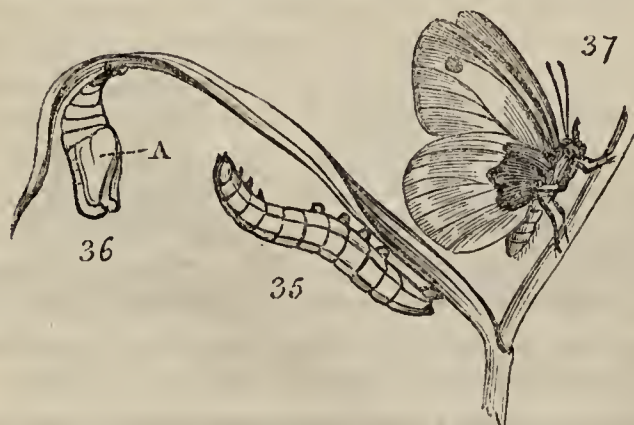
The *Hemiptera*, *Orthoptera*, and many *Neuroptera*, undergo this kind of transformation; but amongst the latter there are some—and they are chiefly aquatic, such as the dragon-flies and may-flies—which are furnished with anal or lateral plates or gills for breathing

in the water; these, therefore, require to be formed into a distinct division, the preparatory states bearing in fact less resemblance to the imago than those species which are terrestrial in their larva and pupa states, breathing by spiracles, and greatly resembling the imago. As it is evident, however, that the latter undergo a less decided metamorphosis than the former, we must place the species which have the more decided semi-complete pupa at the head; indeed Mr. MacLeay has separated the others, and applied to their changes the term metamorphosis sub-semi-completa.



Figs. 32, Larva; 33, Pupa; 34, Imago of *Ephemera vulgata*.

The third or total metamorphosis (*Met. perfecta* of Latreille) consequently consists of the Linnæan groups having incomplete, obtect, and coarctate pupæ. These are to be regarded as separate divisions. Amongst these pupæ some resemble the perfect insect, but contracted, and as it were destitute of life; they have limbs, it is true, which are separate from each other, but these limbs, as well as the entire body, are covered with a membranous skin. This covering exists in the other pupæ, but is of a firmer consistence, imitating a kind of bark, and to which the term *corticata* may be applied, and more completely enclosing the limbs in one general covering. To this kind of metamorphosis, which Latreille considers as comprising the obtect and coarctate pupæ, he has applied the term *pupa obvoluta*, observing that the expression *obtect* applies to both, and that that of *coarctata* is too vague; but surely the structure of the dipterous coarctate pupa (i. e., an incomplete pupa enclosed in the skin of the larva) is much more analogous to the structure of the true incomplete pupa (of which some species, as those of museum beetle, *Anthrenus*, are actually enclosed within the skin of the larva) than it is to the obtect pupa of lepidopterous insects; indeed it appears quite evident that if the coarctate section must be sunk at all, it must be in favour of the incomplete, and not the obtect, section.

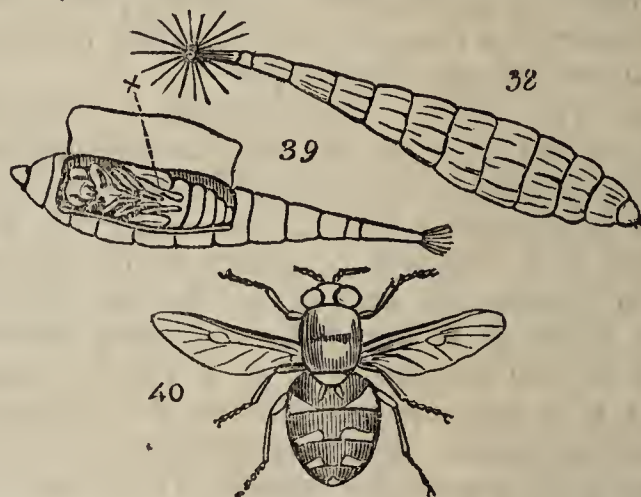


Figs. 35, Larva; 36, Pupa oblecta; 37, Imago of a butterfly (*Hipparchia pamphilus*).

The existence and the number of legs of the larva,

the permanent or variable form of the head, the comparative structure of the organs of the mouth with those of the imago, the number of the spiracles and disposition of the tracheæ, the moultings of the skin, and the quiescent or active state of the pupa, are all important considerations, upon which the distribution of insects from the characters of their metamorphosis may be effected.

Hence the *Lepidoptera* are distinguished by the number of legs, scaly head, &c., of the caterpillar (*Eruca*, Latreille), and the obtect, or, as Latreille prefers calling it, the mummy-formed pupa (*Chrysalis*, Latreille); the *Diptera* are distinguished by their worm-like larvæ (*Vermilarva*, Latreille), and their



Figs. 38, Larva; 39, Pupa coarctata; 40, Imago of *Stratiomys chameleon*.

more or less oviform pupa (*Pupa*, Latreille); the *Coleoptera*, *Hymenoptera*, and some *Diptera*, by the scaly head of the larva (*Larva*, Latreille), and the disengaged limbs of the pupæ (*Nympha*, Latreille);



Figs. 41, Larva; 42, Pupa incompleta; 43, Imago of *Chrysomela populi*.

and the *Orthoptera*, *Hemiptera*, &c., by the active imago-like larva (*Demi-larva*, Latreille), and active pupa (*Demi-nympha*). Thus by an ingenious arrangement we have the following distribution of metamorphosis:—

1. *Metamorphosis inchoata*, equivalent to the Linnæan section, having complete pupa.
2. *M. dimidiata*, semi-complete pupa.
 - A. Respiration in larva tracheal. *Gryllus*, &c. (*M. semi-completa*, Fabricius).
 - B. Respiration in larva branchial. *Ephera*. (*M. sub-semi-completa*, MacLeay).
3. *M. perfecta*. Preparatory states, *Semi-larva* and *Semi-nympha*, Latreille.
 - A. Pupa with detached limbs, *P. incompleta*, Linnæus. Preparatory states, *Larva* and *Nympha*, Latreille. (*Coleoptera*, &c.)
 - B. Pupa mummy-shaped, *P. oblecta*, Linnæus. Preparatory states, *Eruca* and *Chrysalis*, Latreille. (*Lepidoptera*.)
 - C. Pupa concealed by an egg-shaped covering, formed of the skin of the larva, *P. coarctata*, Linnæus. Preparatory states, *Vermi-larva* and *Pupa*, Latreille. (*Diptera*.)

Mr. Newman, in the Memoir already alluded to, has given another and equally ingenious arrangement of insects from their preparatory states; the names of his groups are, however, like those of Linnæus, founded merely upon the nature of the pupa state; and therefore cannot be applied as characteristic of the general metamorphosis. His arrangement is as follows:—

Amorpha, in which the penultimate state is provided neither with mouth nor organs of locomotion; consequently it neither eats nor moves, neither does it bear any resemblance to the perfect state.

1. *Lepidoptera*. 2. *Diptera*.

Necromorpha, in which the penultimate state is provided with mouth and organs of locomotion detached from the body, but so enclosed in a case that it can employ neither. The resemblance, therefore, to the perfect insect is very considerable, excepting in total want of motion.

3. *Hymenoptera*. 4. *Coleoptera*.

Isomorpha, in which all the stages are active and voracious, and of a similar form.

5. *Orthoptera*. 6. *Hemiptera*.

Anisomorpha, in which appear the amorphous, necromorphous, and isomorphous characters, together with a typical and distinct character.

7. *Neuroptera*.

The *Amorpha*, although thus divided into the two orders *Lepidoptera* and *Diptera*, are said to be divisible from the metamorphosis into two distinct sections, separated by the fact of their possessing or not possessing, in the penultimate or quiescent state, the last skin of the antepenultimate or previous state. Those which retain such last cuticle are termed *Amorpha dermatata*, and those which do not retain such skin are termed *Amorpha adermata*, an evident misnomer, since if they do not retain this last mentioned skin, they still are clothed in their own. But in the following page we are informed that the *Amorpha adermata* actually “retain two distinct coverings, thus resembling the *Amorpha dermatata*.” When, however, we look more strictly at the character of the metamorphosis of these groups, and observe the ill effect which its employment has in reference to the *natural* distribution of insects, we shall at once see that this distribution, ingenious as it is (especially with reference to the septenary classification of insects, maintained by its author), and indeed any distribution of insects from the character of metamorphosis alone, evinces the absolute necessity of recurring to other characters. Thus, whilst one division of the *Amorpha* comprises the *Diptera* with true coarctate pupa, the other comprises not only all *Lepidopterous* insects, but also many *Diptera*, which must be more nearly allied to the other *Diptera* than they are to the *Lepidoptera*. Moreover, even amongst the adermatous *Diptera*, many species exhibit a necromorphous rather than an amorphous appearance; when, however, we regard the real character of the coarctate pupa (which corresponds with the *Amorpha dermatata*), we are at once confirmed that the real character of the dipterous pupa is necromorphous and not amorphous. The pupa of the bee is truly necromorphous; its larva forms, or else is by its parents or their assistants (neuters) enclosed in a cell, where it is safely guarded; so that it has only to cast off its skin and appear in its naked, defenceless, but yet defended state. But the flesh-fly is differently situated. Its functions in nature are such,

that the least waste of time would be to their prejudice. We have accordingly seen that in its first production this is amply provided against, although in what certainly appears to be an anomalous manner, (see our articles, *BLUE-BOTTLE FLY*, and *BLOW-FLY*.) During its growth as a larva it undergoes no moultings of the skin, which are attended in other insects with a certain loss of time, and on arriving at its full growth the same character is still retained. The skin is not cast, but, with the most admirable foresight on the part of the Great Contriver of both great and small, becomes an envelope answering all the purposes of a silken cocoon or a waxen cell, and serves for the defence of the defenceless inhabitant enclosed within, and which, when carefully examined, proves to be a truly necromorphous pupa.

But there are other insects belonging to the necromorphous section, which indisputably prove the real identity of these apparent differences, and shew the necessity of looking at the subject in the most general manner. Thus some coleopterous pupæ (example the *Staphylinidæ*), and some hymenopterous pupæ (example, the *Chalcididæ*), are as truly mummy-formed as the lepidopterous pupa, whilst other coleopterous pupæ (example, *Anthrenus*, *Attagenus*) do not quit the larva skin, and are, therefore, amorphous. Again, some necromorphous pupæ (example, the *Trichoptera*), although inactive during a great part of their remaining in that state, become as active, previous to assuming the perfect state, as any of the isomorpha; and lastly, if we carefully examine the objected pupa of a butterfly, we shall at once perceive that the only character which separates it from the necromorphous, or incomplete pupa of a beetle, is, that its limbs are laid more compactly upon its breast, each, however, being inclosed in its distinct sheath.

The preceding considerations appear sufficiently to prove that the pupa state of insects is a distinct state, and that instead of being regarded merely as the matured state of the larva, it would be more correct to regard it as the immature state of the imago. This will be still more evident from a more precise investigation of the form and structure of pupæ.

1. Of those species which undergo the metamorphosis *inchoata* of Latreille, the pupæ differ only from the preceding state by an increased size, and occasionally an increase in the number of segments. Crabs, spiders, centipedes, lice, spring-tailed insects (*Thysanura*), are subject to this kind of metamorphosis, which is so slight that it is impossible to decide whether one of these animals has arrived at its perfect state or not; and hence, as Fabricius observed in his *Philosophia Entomologica*, it is probable that many supposed species of spiders, &c., have been formed out of the immature states of these animals.

But there are some insects belonging in reality to the winged tribes, but forming an exception by being destitute of wings in the perfect state; such are the bed bugs, many individuals of *Velia*, *Hydrometra* and *Gerris*, likewise numerous *Phasmdæ*, and other apterous *Orthoptera* and *Hemiptera*.

2. Of those species which undergo the metamorphosis *dimidiata* of Latreille, the pupa has been most appropriately termed semi-complete by Linnæus, we therefore cannot approve of the alteration of this term to sub-incomplete, proposed by Burmeister: the pupa being intermediate between the larva, in which the body is completely apterous,

and the imago, in which it is furnished with fully developed wings: and being active like the larva, and provided with these organs, but so wrapt up as to be easily enclosed within four short cases, which arise in pairs from the back of the second and third segments of the body. Here belong the tribes of locusts, grasshoppers, mantes, cockroaches, earwigs, bugs, and treehoppers, in all which the resemblance of the pupa to the imago is very distinct. Here, also, are generally arranged the dragon-flies, and the may-flies (*Ephemera*), but in these groups the likeness of the pupa to the imago is less distinct, the organs of respiration being quite different, as above noticed, and the structure of the mouth being totally dissimilar. These groups, accordingly, are said by Mr. MacLeay to undergo a sub-semi-complete metamorphosis. There is another peculiarity connected with this species of metamorphosis, which sufficiently proves that here we are intermediate between the merely rudimental and the perfect metamorphosis, and that the perfection of the animal is not so dependent upon metamorphosis as in the subsequent perfectly metamorphic division. Thus there are many species belonging to this section, which remain throughout their life in a state of imperfection; of this, a common instance



Figs. 44, Apterous imago; 45, Winged imago of *Velia rivulorum*.

occurs in the Hydrometridæ, or water measurers. These insects, which are to be observed skimming along on the surface of the water, are generally found destitute of the slightest rudiments of wings; they, however, continue their kind, but occasionally certain individuals will be found in company with them with the wings fully developed. Now it is impossible to regard the former as pupæ, because they have no rudiments of wings; neither can we consider them as larvæ, because they are as large as the winged individuals, and are able to propagate. Accordingly they have been generally regarded as distinct apterous species; but a more extended investigation of these groups of insects will prove the specific identity of these imperfectly developed, but still perfect* (as regards their powers of propagation) individuals with the winged specimens. Thus, there are many species, which, instead of being generally wingless, are furnished with short rudimental wings, and which are nevertheless capable of reproduction; hence, as well as from the structure of the rudimental wings, it is evident that they cannot be pupæ, and yet it occasionally happens that in a few individuals the wings are fully developed; thus the specific identity is not questioned, why then should it be in the former? the principle in either case being identical.

3. In those species which undergo the perfect metamorphosis of Latreille, the pupa is incapable

of eating and walking, and may be considered as a most characteristic state of the insect's existence. Here belong the tribes of *Coleoptera*, *Hymenoptera*, *Trichoptera*, and many *Neuroptera* and *Diptera*, having an incomplete pupa; the *Lepidoptera* having an obtected pupa, and the remainder of the *Diptera* and *Strepsiptera* having a coarctate pupa. We have already noticed the distinction of these kinds of pupæ; but as they all (including the coarctate pupæ when examined without reference to the external covering formed of the indurated skin of the larva) resolve themselves into one general mode of construction, that of being inactive, and having the limbs folded more or less closely upon the breast, it will be convenient to examine them in one general view. Here, then, we find the form of the future insect much more visibly impressed upon the insect than during its previous state; the head, thorax, abdominal segments, and the various limbs, are more or less discernible. The external covering in this state is variable in its consistence, according to the situation in which the pupa state is undergone; thus in those species especially belonging to the coleopterous, hymenopterous, and dipterous orders, which are safely protected from external injuries, the pupæ are soft and the envelope membranous; but in the *Lepidoptera*, and more especially those which are naked, the pupa (chrysalis) is of a hard texture. We have already, in our article CHRYSALIS, given some general observations which are applicable to the construction of this state, and which it will be unnecessary to repeat. A clear idea of the arrangement of the limbs in the three principal divisions of incomplete, obtected, and coarctate pupa, will be obtained from the following figures, in which the same letters refer to the same organs throughout: fig. 46 representing a coleopterous,

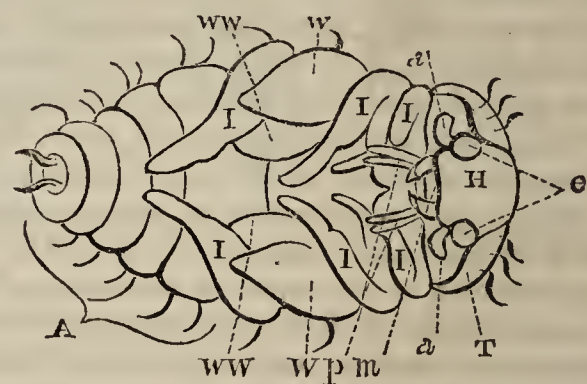


Fig. 46. Pupa of the great water-beetle (*Hydrous piceus*).

fig. 47 a lepidopterous, and fig. 48 a dipterous pupa; the latter stripped from the cocoon-like skin of the larva. The letter H referring to the head,

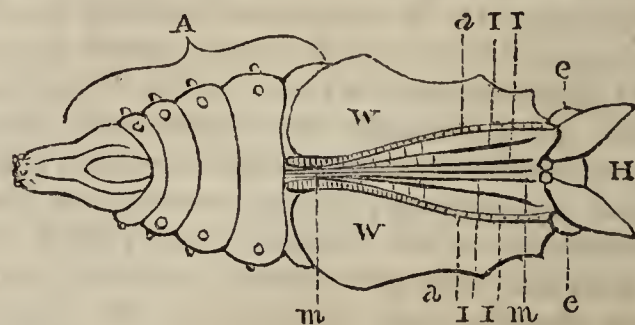


Fig. 47. Pupa of the tortoise-shell butterfly (*Vanessa urticæ*).

r the thorax, A the abdomen, a a the antennæ, e e the eyes, m the mouth, p the palpi, w the upper wings, w w the posterior wings, I I I I the legs.

It must, however, be borne in mind, that in these pupæ the limbs have not yet acquired their

* "The true criterion of animal as well as vegetable perfection is the ability to continue the species."—Mac Leay's *Horæ Entomologicæ*, p. 446.

full size, and the abdomen is not yet reduced to the size which it will possess in the imago state.

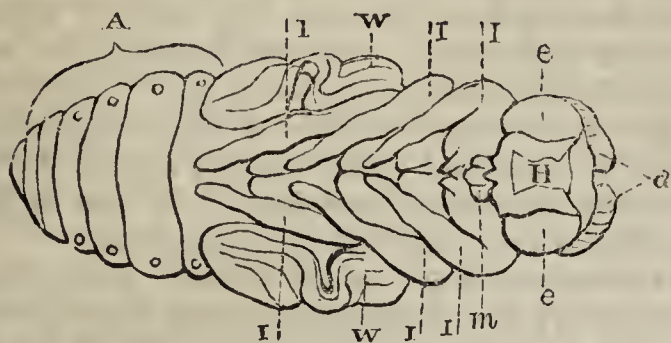


Fig. 48. Disengaged pupa of *Stratiomys chamæleon*.

Pupæ are ordinarily of an elongated oval form, the thickest part being towards the head; the body is generally smooth, but in some instances various spines or hairs are to be observed upon various parts of the body; and others, especially the chrysalides of butterflies, are angulated, as described in our article *CHRYsalis*. In some aquatic pupæ, as described in our article *CHIRONOMUS* and *CULICIDÆ*, the back of the front part of the thorax is furnished with exserted breathing organs. The structure of the terminal segment of the buoy is also variable; one of the most remarkable variations, essentially serviceable in effecting the suspension of suspended chrysalides has been described in our article *BUTTERFLY*; and it may here be noticed that in those species of *Hymenoptera*, which have the ovipositor long and exserted, it is generally curved upon the back of the abdomen, although in some it is stretched out at



Fig. 49. Pupa of an *Ichneumon* and *Callimome*.

length. In many of the wood-boring species of *Lepidoptera*, (as, for instance, the Goatmoth) the abdominal segments of the pupa are furnished with transverse ridges of minute hooks, which are serviceable to the insect, when about to assume the imago state, in working its way to the orifice of its burrow, the hooks, by the alternate contraction of the abdominal rings, being employed as anchors in preventing the insect from falling backwards.

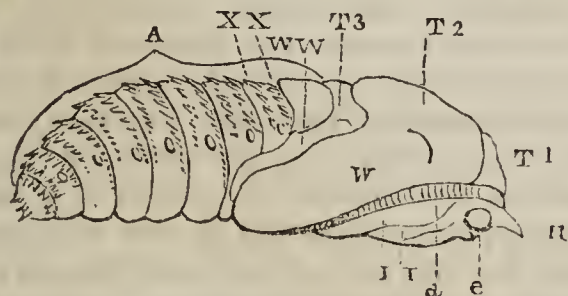


Fig. 50. Lateral view of the pupa of the goat-moth, lettered as Nos. 46, 47, and 48; and T 1, T 2, and T 3, being the three thoracic segments; XX, two of the rows of hooks.

There is a curious circumstance connected with the development of the insect structure, especially interesting as regards the pupa state of insects, and it is one which has hitherto received but very little attention. In the larva state the body is composed of the ordinary and typical number of

segments, but in the perfect state some of the segments are not to be found. The change, therefore, must take place at the period of the insect's assuming the pupa state. Dr. Ratzeburg, indeed, accounted for the loss of one of these segments, by asserting that the head of the pupa of the bee corresponds with the head and first segment of the body of the larva; but this, as we have already said, is certainly inaccurate, as we have proved by direct observation, and as is further evidenced by the leg-bearing structure of the first segment in many larvæ. The loss must therefore occur in the abdominal segments; but upon this branch of the subject we require more direct investigations than have yet been devoted to its elucidation. As regards the segmental development of the earwig, an elaborate paper has lately been read before the Entomological Society, but it is not yet published.

Pupæ, in general, are of a dirty white colour when their situation is under ground, or in cases artificially constructed by the larvæ. Those, more especially which lie naked under ground, are of a dark bright brown, whilst those which are naked, and exposed to the action of the light, are more variable in their tints, some being gilded as in the aureliæ or chrysalides of butterflies.

The period passed by insects in the pupa state is very variable, the variations extending from a few days to as many years. Ordinarily, its extent is determined by the circumstances to which we have alluded in our observations upon the duration of the larva state; that it is chiefly dependent upon the temperature of the atmosphere. Providence has wisely ordained that the development of the perfect insect shall not take place until the season when proper food for its own sustenance is at hand, or a proper situation for the deposition of its eggs is to be discovered. Hence some insects are produced earlier, and others later, in the season; and in doubled brooded species, or those of which there are two generations in a year, the early brood passes but a very short time in the pupa state, whilst the later brood remains throughout the winter as pupæ. Hence Reaumur was enabled by experiments with chrysalides to abridge or extend their lethargic state by the artificial heat or cold; the chrysalides of various lepidopterous insects, which would not ordinarily be produced until spring, being placed in a hot-house, and the butterflies being developed in the middle of the winter, the contrary effects being produced when they were placed in an ice-house. Hence it is evident that by the action of an increased temperature a certain evaporation of the fluid matter, with which the newly-formed chrysalis is filled, takes place; but we can by no means agree with Kirby and Spence, that "this necessary transpiration, other circumstances being alike, must take place sooner in a small than in a large pupa;" and, consequently, "that small pupæ continue in that state a shorter time than those of larger size:" indeed, we are disposed to question the correctness of the latter assertion, and to say, on the other hand, that the duration of the pupa state is totally independent of size. We could adduce hundreds of examples in support of our assertion, but it will be sufficient for our purpose to observe that the largest lepidopterous insect, the great Death's-head moth, requires, according to Harvarth, but one month at the end of autumn, when the weather has been comparatively cold, to undergo its pupa state. If

evaporation were the sole operation to which the pupa was subject, there would be sufficient grounds for the theory of evaporation entertained by Swammerdam, Reaumur, Kirby, and Spence; but such is not the case, for Reaumur having enclosed a pupa in a stopped glass tube, collected only several drops of water, which were condensed against the sides of the tube, the pupa having only lost one eighteenth part of its original weight. Hence the development of the organs of the enclosed animal, by absorption and assimilation, constitute the great operation which the pupa has to undergo, and this must, of course, be of equal duration, whether the insect be a large or a small one, although it may be accelerated or prolonged according to the degree of temperature of the atmosphere.

In our articles *CHRYMALIS* and *ERIOGASTER*, we have noticed some curious and inexplicable circumstances relative to the retarding of the production of certain individuals for one or more years, although placed in precisely similar circumstances with others which are evolved at the ordinary and stated time. The same facts have been observed respecting other moths.

We are now to notice the mode in which the insect emerges from its pupa skin. Ordinarily this is effected as heretofore, in consequence of the increased size of some, at least, of the segments of the body, especially those of the thorax; and it is now only necessary for the insect to give to its enclosed body various contortions, when the skin splits generally down the back, and permits the escape of the enclosed insect. In chrysalides, the slit extends gradually down the sides of the wing cases, and on each side of the leg cases, so that the outer skin of the chrysalis may be said to be split into four portions; on its exclusion, the insect is soft, weak, and covered with moisture. The elytra and the wings, at first, are but of a small size, their form, however, soon changes, their thickness diminishes, and their ordinary size is acquired, the air tubes distributed throughout the body, and especially in the wing, performing the important office of inflation, and chiefly assisting in effecting the change, so that in a very short period the insect has arrived at its full size, and acquired the utmost perfection of all its organs.



Fig. 51. Tortoise-shell butterfly just emerged from the chrysalis.

The wings of lepidopterous insects, as they lie within the pupa skin, exhibit all the future markings of the butterfly and moth, but of course of a reduced size. The wings themselves appear perfectly flat, and it is difficult to conceive how these organs expand to their full dimensions, all these markings retaining their relative sizes. The difficulty is, however, remedied on denuding the wings of their

scales, when their surface is discovered to be entirely formed of an innumerable series of minute wrinkles, giving the wing an elasticity, by which we can stretch them to nearly double their size, by moistening them with water. If we imagine the scales to be placed upon the upper edge of each ridge, and that they increase in size as the wings expand, we shall be furnished with a further clue to the solution of this interesting question, as to the mode of expansion of the wings of the *Lepidoptera*.

In the aquatic pupæ, which produce aerial insects, it is necessary for the pupa to quit the water previous to putting on the perfect state; thus the pupa of the dragon fly creeps up the stems of some adjacent plant; and that of the gnat half portruding its body above



Fig. 52. Gnat emerging from its aquatic pupa.

the surface of the water, the skin splits down the back and the gnat, making use of its pupa case as a boat, gradually draws itself out of its case, upon which it sits until its wings are expanded. In pupæ which are enclosed in cocoons or other cases, different modes of escape are required. How, for instance, can a moth, whose beautiful wings and crested thorax indicate no previous struggle, make its way through the cocoon, often as solid as the hardest wood. This is effected either by the peculiar construction of the cocoon, or by the operation of some fluid emitted by the insect on its arrival at the perfect state. In like manner the pupæ of flies and other coarctate diptera force off a case, at one end of the dried skin, by inflating the middle of the head into a large membranous vesicle; and the pupæ of the caddice flies, which are inclosed in the case in which they resided whilst larvæ, make their way through the net work covering which they had spun to defend its entrance. But the most curious circumstance connected with this subject, is the mode of extrication of the males of the Gall insects (*Coccus*), the pupæ of which are strictly coractate, the imago making its escape backwards from beneath the flattened skin of the larva, its wings being turned backwards over the head.

The development of insects is very rarely attended with those deviations from the ordinary rule, which are sometimes met with in other tribes of animals. It has, however, been recorded in the *Entomological Magazine*, No. 12, that a male and female emperor moth (*Saturnia pavonia minor*) were produced from a single larva of an extraordinary size. Kirby and Spence also mention that, according to Kleesius, a German entomologist, two specimens of *Gastropacha quercifolia* (the pine lappet moth), were produced from one pupa, which was large, being full two inches long, and one thick. These circumstances are sufficiently marvellous, but the most marvellous fact of all is that affirmed by Mr. Dale, in the *Magazine of Natural History*, Nos. 19 and 34, viz., that he "once had a

specimen of *Bombyx menthastri*, and six of *Ophion vinulæ*, hatched from the pupæ of *Bombyx vinulus*, which is certainly a curious fact." We presume from this statement, which is, however, sufficiently destitute of precision, that these various specimens were produced from a single pupa of the puss moth. On throwing off the pupa covering, the arrival at the perfect state is ordinarily completed; but a remarkable exception to this occurs in the *Ephemera*, of which we have given an account in our article upon these insects. We will, therefore, only add that this occurrence of a subsequent moulting in this group does not seem to warrant the conclusion, that the preceding state is not that of the pupa, nor to overthrow the opinion that the pupa state ought not to be regarded as a distinct one. We apprehend, indeed, that as the *Lepidoptera* and the dragon flies are known to shed a similar pellicle, its existence throughout the winged insects ought, from analogy, to be presumed, until direct observation proves the contrary.

We are now to examine

Section III.—*The general structure of insects as especially exhibited in their perfect state.* Our attention must now be directed to the final and perfect state of insects, and in the first place to their structural peculiarities. This branch of the subject will naturally divide itself into two branches, first, the anatomy of the external parts of the body; and secondly, that of the internal organs.

1. *External anatomy.*—Insects being animals destitute of any interior skeleton, it is necessary that their external covering should be much thickened, and rendered sufficiently strong to give support to the numerous muscles which are internally attached to it. Hence in the majority of insects this covering is of a scaly or horny consistence. It is, however, modified by the nature of the habits of the individual. Thus the *Aphides*, *Hemerobius*, *Ephemeræ*, and other short-lived insects, have the skin very soft; whilst those which generally take up their abode beneath stones, under the bark of trees, in water, &c., are more strongly defended against accidents by the solidity of their envelope, than those which live upon flowers. Those, also, which reside beneath the bark of trees, or under stones, have a flattened form, whilst those which burrow into wood are cylindrical.

The body of insects consists of a series of rings connected and articulating with each other, by the assistance of muscular membranes, whereby the insect is enabled to contract or lengthen, narrow or dilate, its body, and so give to it all the necessary movements.

We have said that the external integuments of insects exhibited a horny appearance, nevertheless there is no real analogy between the scaly covering of a beetle, and horn, their chemical properties being quite distinct; to be convinced of which, it is sufficient to apply them separately to the flame of a lamp; and the same distinction is proved by placing them in a solution of potash, of the temperature of boiling water, in which the horn will be dissolved; but the covering of the beetle undergoes no change, except that of loss of colour. The base of the latter is found, by chemical analysis, to consist of a peculiar substance, found only in the integument of annulose animals, which has been termed chitine, and which forms the outer covering; albumen also, an animal extract, a small portion of carbonate of potash, phosphate of lime, and phosphate of iron, and an oil variable in colour according to the colours of the organs from

which it is extracted, form parts of the insect integument, but chitine is by far the greatest portion of the materials of which it is composed.

By Linnæus, the body of an insect was divided into four parts, the head, trunk, abdomen, and limbs. The latter, however, more properly belong to the second of these divisions, of which they are appendages; and the term thorax is now generally applied to designate the Linnæan trunk. Hence we have now to treat upon the head, thorax, and abdomen. These three divisions, as respectively comprising the principal organs of sensation, locomotion and generation, appear to be completely in unison with nature, and have accordingly been universally adopted and employed. That persons ignorant of the comparative anatomy of insects should have blundered in their trivial descriptions of insects, and miscalled any of these parts, can be no argument against their correctness; neither can we at all comprehend the assertions of a recent author, who would impose, in lieu of this distribution, a useless (as it appears to us) series of names for each individual segment, stating that "their wings are either thoracical or abdominal appendages, as an entomologist pleases,"* and that, therefore, there are no such parts in an insect as a thorax or an abdomen.

But in addition to these three primary divisions, the body of insects consists of a series of secondary divisions, or rings, of which the head exhibits no distinct trace; the thorax, on the contrary, is always divisible into three segments; and the abdomen is, in general, variable in the numbers of its segments from six to nine, exclusive of the organs of generation. On comparing the different segments of a perfect insect, various striking differences will be observed, depending principally upon the presence or absence of the appendages, or organs, which these segments respectively support, as well as upon the degree of their development. Thus when one of these segments has attained its greatest extent and complication, and the appendages, which it supports, have reached their maximum, it is presumed that the segment itself is composed of a certain number of distinct pieces, more or less distinct, with which it is essential to possess an acquaintance. To arrive at this result, it is evident that we must examine one of the thoracic segments in

* Newman on the Osteology, or External Anatomy of Insects, a series of letters commenced in the Entomological Magazine, and containing a great deal of very valuable matter, but written in a style quite perplexing to a learner whilst endeavouring to unravel many of the statements which it contains. Thus, when the author asserts that the limits of the abdomen have been always ideal; that the abdomen may comprise either seven, eight, nine, ten, or eleven of the thirteen segments of an insect's body; and that, consequently, the wings of a beetle are generally considered abdominal; a tyro relying implicitly upon such a statement, would conclude that the researches of all previous anatomists had been of the most unphilosophical kind. Mr. Newman must, however, be well aware that there is not the least shadow of a foundation for them to rest upon. Linnæus and his followers, it is true, restricted the name of thorax in the beetles, to the first segment following the head, but did it thence follow that all the remaining segments must necessarily be abdominal? This would, indeed, be the case, if Linnæus had divided the body of an insect into the head, *thorax*, and abdomen; but this is not the fact. He says, "corpus dividitur in caput, *truncum*, abdomen, artus;" and he subsequently gives the thorax as a compound part of the *truncus*, which he says is situated "inter caput et abdomen." Thus, by speaking of the term thorax, when used in its Linnæan restricted sense, as though it had been used in its now most general sense for the whole Linnæan *truncus*, the learner is left in doubt; and all preceding authors made to appear absolute fools, and yet the author himself is enabled, by the researches of these very men, to gain credit for having introduced a most philosophic simplicity into the science of insect anatomy, with the majority of his readers.

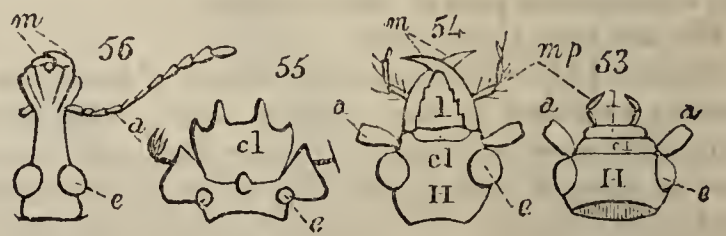
preference to the others, because they are most fully developed, and most complicated in their structure. The pieces composing one of these segments are divided by M. Audouin, who devoted a great deal of attention to this branch of the subject, into three distinct kinds, dorsal, lateral, and ventral. Mr. Mac Leay, however, considers them only as dorsal and ventral, uniting the lateral with the ventral. The ventral portion consists of a simple piece, of which the form is very varied; this is named the sternum. Attached internally to this piece, at its posterior margin, is another single piece, variable in its form, but generally resembling the letter Y, and appearing necessary for the support and protection of the nervous system. This piece, as being attached to the head, thorax, or abdomen, is respectively termed the entoccephalus, entothorax, and entogaster. The lateral pieces are more complicated, each being composed of two pieces; the one, anterior, articulating with the sternum, and directed upwards, constituting the episternum, behind which the other is situated, and which is in connexion with the base of the leg, and is called the epimeron. The upper surface of the thoracic segment is also composed of a number of distinct pieces, which are respectively named præscutum, scutum, scutellum, and postscutellum, and which successively follow each other. Such is supposed, theoretically, to be the structure of each segment of the body of the insect; and the fixed number of parts thus discovered, is supposed to exist in all annulose animals, sometimes being distinct as when the segment has reached its maximum of development, but still more frequently more or less rudimental, or soldered to adjoining pieces, as required by the variation of development. Some pieces may even entirely disappear, and the segment may appear to consist rather of a single piece, or, on the contrary, of two or even a greater number of segments united together. Modifications of this kind are traceable not only in different insects, and in the different segments of the same insect, but even in any single determinate segment, when examined in the various states of the same individual. The comparative examination of these segments of the insect skeleton has singularly simplified the anatomical study of these animals, placing it upon a firm basis, and more rigorously compelling the precise determination of organs which had previously been either entirely overlooked, or had only been regarded without reference to the analogous formations of other insects; and hence to any organ which happened to be singularly developed, a name was given without the least reference to the comparative structure of other insects, or the same comparative parts in the other segments of the same individual.

It would carry us too widely into the field of theoretical inquiry, were we to show that the head, and various abdominal segments, were organised in a manner strictly analogous to those of the thorax; neither could they be done effectually without a reference to the typical structure of annulose animals in general—a vast and difficult subject of investigation. We will, therefore, now confine our attention to

A—*The head, or the seat of the organs of sensation.*

The head, or first segment of the body, is united to the anterior part of the thorax by a distinct articulation, and may be considered as a kind of solid corneous case or box, having an opening in the centre of its anterior part, where the mouth is placed. It is of a triangular or oval shape, with the narrowed part

advanced in front, the middle of the opposite side, or base, being occasionally prolonged into a neck. But there are numerous modifications of this form, and the head is often buried as far as the eyes in the prothoracic cavity. On minutely examining the skull, it will be found that it consists of several regions. These are, the epicranium or skull-cap, composing the greater part of the head, of which it chiefly occupies the upper and posterior part. This is bounded in front by the clypeus (*c*), or shield of the mouth, which generally lies above the parts of the mouth (*m*), and the under side of the head is covered by the jugulum, or throat. At the sides of the epicranium are situated the large compound eyes (*e*), between which, when present, the ocelli (*o*), or simple eyes, are placed, and the antennæ (*a*) are inserted nearer to the mouth. But all these parts will require a more precise examination.

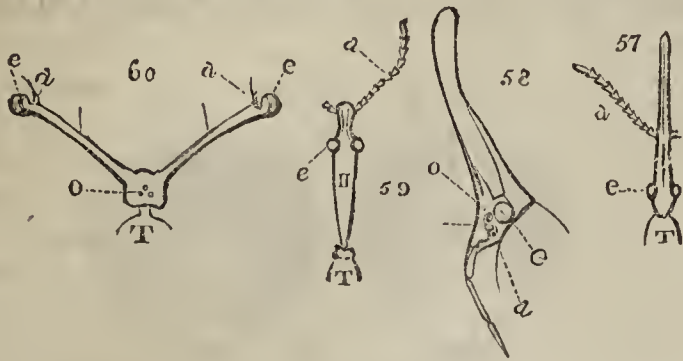


Figs. 53, Head of *Dyticus*; 54, ditto *Oxycheila*; 55, ditto *Helio-cantharus*; 56, ditto *Acanthothorax*.

The head is generally of a corneous, or coriaceous texture, although at times it is membranous or vesiculose; and its form is modified from oval, or globose, to longitudinal, heart-shaped, compressed, cornuted, rostrated, &c. The parts of the epicranium, and its frontal part, the clypeus, have been variously regarded and named by different authors. Thus Kirby and Spence divide the upper surface of the head into the nose (*rhinarium*), hind nose (*postnasus*), forehead, crown, occiput, cheeks, and temples, and the under surface into the lora and jugulum; and it is not to be denied that, in the numerous modifications which occur in the form of the heads of insects, there are to be found portions developed to an extent, and to which, from their analogy with the parts of the head of the higher animals, it may seem serviceable to give analogous names; but it is impossible to limit the extent of these parts; and therefore a general definition could only be applied to each; as, that the forehead is that part of the head which is between the eyes, and when the head begins to assume a flattened form; and the cheeks those parts which lie at the sides of the head between the eyes and the mouth. In many insects the head is united to the thorax by a membranous tube or neck, consisting, as in the *Diptera* and *Hymenoptera*, in which the motions of the head are very free, of the attenuated fore part of the thorax. In some beetles, however, the term neck is applied to a narrowed portion of the skull, which forms a kind of rotule, playing in the opening of the thorax.

The clypeus (*c*) of Fabricius, or the nose of Kirby and Spence, or the epistomis of Latreille, is an important part of the head, as occasionally, from its development, and the consequent want of development of the true upper lip (*labrum*), it takes the functions of the latter, and serves, as the name imports, and as it was at first employed by Linnæus in the lamelli-

corn beetles, as a shield for the mouth. That there are grounds for not strictly regarding it in every insect as a mouth-shield, cannot be denied; but it



Figs. 57, Head of Brentus; 58, ditto Fulgora, 59, Apoderus; 60, Diopsis.

would be equally incorrect to reject it on that account, as it would be to reject that of *labrum*, or upper lip, because the latter organ occasionally is quite unserviceable as a lip. Still less do we feel inclined to regard it as a nose. Its form is very variable according to the form of the head. Thus, in an elongated head, it will be distinct and square, or rounded; and in those with a shorter head it is transverse. In the rose beetle it has a deep frontal notch; in the sacred beetle it is ornamented with several scalloped notches; in the hornet it is subquadrate; in the grasshopper rounded; and in the rove beetle transverse.

The organs of sense affixed to the head are:—

Fixed—*a* The composite eyes.

b The ocelli, or single eyes.

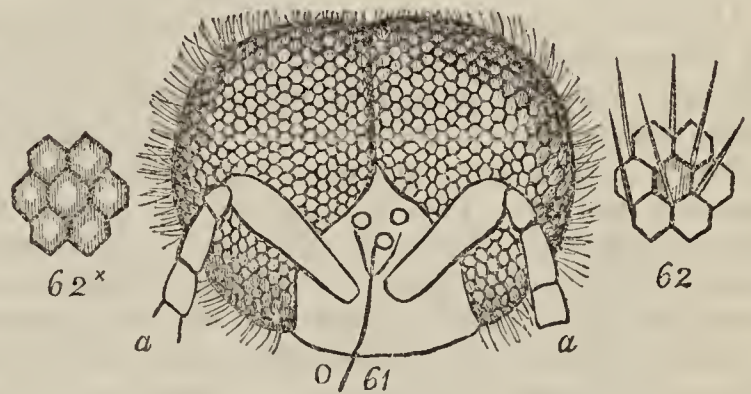
Moveable—*c* The antennæ.

d The trophi, or organs of the mouth.

In relation to the mutual dependence of these organs upon each other, and upon the general character of the insect, we are sure that we cannot do our readers greater service than by quoting the following admirable passage, by Mr. Newman, from the *Entomological Magazine*:—"Professor Rang has prettily observed, that every instrument, whether it be for the generation or transference of power, has a best size and a best form. Nature, in the formation of her instruments, has always adopted that best size and best form. If her creatures wanted but to see, a globular eye floating in space might perhaps be the uniform character of the animal world; if to see and to eat, an eye and a mouth would be given; if to move swiftly in the air were desirable, wings must be supplied; if on earth, legs must be added; if in the water, fins. To carry all these organs, and to contain muscle to guide and govern them, a body must be added. Each part of the body will be of the best size and best form for the functions it has to perform. We have seen that insects in their larva state have a very uniform allowance of muscle to each segment. In the imago the charge of supporting the whole body in the air is entrusted sometimes to a single segment; and, in order to supply sufficient strength for the purpose, nature robs the neighbouring segments of their muscle, and gives it the one which needs it. In the *head*, the *mouth-feelers* and *eyes* operate in the same manner one on another. Observe the dragon-fly, the emperor of his tribe; his wings rustle as he hovers stationary and hawk-like in the air; his appetite is insatiable; his food the active occupants of his own element; it is given to him in charge to set bounds to the increase of the insect race; he beholds his prey afar off; he darts on it like the rapidity of a

lightning flash; to devour it ere life is departed is the work of an instant; he sails round and round; he soars up and down; when the sky is serene, he seeks his prey, like the swallows, almost beyond the reach of human sight. What organs does such an animal require? Are they not these, eyes, mouth, and wings? How has nature provided for his wants? Regard his head—below, it is all mouth; above, it is one continuous eye. Contemplate his wings—their character is strength and lightness, power and activity. His body is slender and graceful; like a rudder, it serves as an instrument wherewith to shape his course. Porrected feelers, whether cranial, lateral, or maxillary, would be comparatively useless to an animal whose dependence for support is on the keenness of its vision and the velocity of its flight. We find them but little prominent; his every organ of the required size. The same law obtains as certainly and unvaryingly in form. There is truly a best form and a best size, and Nature always provides both."

a. The composite eyes.—The eyes of insects, unlike those of the higher animals, are immovable, horny, and unprotected by any eyelid, of a large size, and placed at the sides of the head, sometimes entirely occupying the sides, and sometimes being so extensive that scarcely any other part of the head is left perceivable; moreover, it is a curious circumstance, that the eyes are sometimes clothed on the outer surface with fine bristles. These organs are generally hemispheric, and of a circular, oval, or kidney-shaped form; and when more closely examined, they



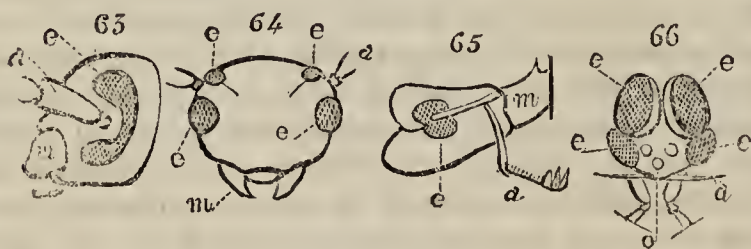
Figs. 61, Head and eyes of the bee; 62, Part of the faceted portion showing the hairs between the facets.

are found to consist of a very great number of minute hexagonal lenses, giving the eye a reticulated appearance. Each of these lenses operates as a distinct organ of vision, and hence the number of the eyes may be said to correspond with the exact number of these hexagonal facets; various calculations have been made as to the number of these organs. Muller has given a list of their number as derived from the observations of Swammerdam, Leuwenhoeek, Andre, Baster, Reaumur, Lyonnet, Goetze, Puget, and Schelver.

	Lenses.
In the ant there are . . .	50
In the convolvulus sphinx . . .	1300
In the common house fly . . .	4000
In the silk-worm moth . . .	6236
In the goat-moth . . .	11300
In the dragon-fly . . .	12544
In a butterfly . . .	17355
In a mordella . . .	25088

And, according to a calculation cited by Geoffroy, there must be not less than 34,650 of such facets in the eye of a butterfly. When one of the eyes is de-

tached from the head and cleaned, the lenses are found to be as clear as crystal. Reaumur fitted one of them thus removed to a lens, and found that he was able to see through it distinctly, the object being, however, greatly magnified. Ordinarily the eyes are entire, but sometimes the antennæ are inserted so close to their inner margin that the eyes are thrown out of their ordinary form, and more or less surround the base of the antennæ. Sometimes even the eye is thus completely divided into two parts by the antennæ being inserted in the middle. The same thing occurs in both respects, when the lateral margins of the head become acute, in which case they enter the anterior limb of the eye, and either partially, as in *Dorcus*, or entirely, divide it in two parts; thus forming an upper and an under eye: hence these insects may be said to have four composite eyes, which in fact appears to be the case in the whirlwig-beetles (*Gyrinus*), and in the males of some May-flies (*Ephemera*).



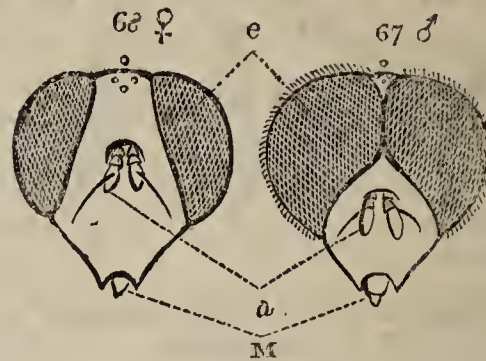
Figs. 63, Head of *Coptocephalus*; 64, ditto of *Tetraopes*; 65, ditto of *Dorcus*; 66, ditto of *Ephemera bioculata*.

Ordinarily the eyes are sessile, that is, attached by their entire breadth to the head; but in some instances they are placed at the extremity of footstalks formed of a continuation of the corneous covering of the head, and consequently incapable of separate motion. This is especially the case in the dipterous genera, *Achias*, *Diopsis* (fig. 60), *Plagiocephala*, and others, in some of which the footstalks are nearly as long as the entire body; the same occurs in some species of strepsipterous insects, as well as in some exotic bugs (*Heteroptera*). Again, the eyes of insects are generally either almost flat, or but very little elevated above the surface of the head (fig. 53); but in many cases they are almost globose and very prominent (fig. 54), a peculiarity respecting which, and connected with their habits, has been noticed by the late celebrated Swedish entomologist Dalman, who observes that the very prominent eyes of insects generally indicate their habitation to be either in sandy situations or upon the margins of water; this is exemplified in the coleopterous genera, *Cicindela*, *Elaphrus*, *Omophron*, and *Stenus*, and in the hemipterous genera, *Salda* and *Alydus*. Moreover, insects with prominent eyes seem to be especially rapacious in their habits, as in the genera above mentioned, *Libellula*, *Hemerobius*, &c.

In many dipterous insects a remarkable diversity exists in the size of the eyes in the two sexes, those of the males being very large, and united upon the crown of the head, whereas those of the females are much smaller, leaving a space between them upon the top of the head (figs. 67 and 68). The same also occurs in the male hive-bee.

In some insects, however, the eye appears to be completely wanting; this is asserted to be the case in the remarkable parasitic insect, thence named *Braula cæca*, in the genus of beetles, *Cnidium*, Kirby; and

in the ants forming the genus *Ponera*. In like manner we have been unable to observe the least trace of eggs in more than one exotic species of ant; and in some of the *Centipedes* the same is stated to be the case.



Figs. 67, Head of male; 68, ditto of female *Syrphus*.

b. The *Ocelli* or *Simple eyes* (o in the figures).

These organs (sometimes also named *Stemmata*) are minute nearly globular lenses placed upon the crown of the head or the forehead, between the upper region of the eyes. Unlike the composite eyes, they are often entirely wanting, and are never present in the image unless as accompaniments to the latter. In their organisation they appear to be similar to the lateral point-like eyes of caterpillars or the eyes of spiders. In general they are three in number, placed in a triangle, or more rarely almost in a line. Occasionally, however, there are but a pair of these ocelli, as in many lepidopterous insects, where they are present, although concealed by hairs, in the mole-cricket, in many bugs and smaller frog-hoppers (*Cercopidæ*); in some of the sand-wasps (*Larra*, &c.) the hinder pair are almost obsolete; and in some of the coleopterous insects, belonging to the family *Dermestidæ*, there appears to be but a single ocellus. They appear in the ants to be connected with the development of the sexual character, since the neuters are entirely destitute of them. They are also entirely wanting to the great mass of *Coleoptera* (having been only noticed in a few small *Brachelytra*, *Paussus cruciatus*, and some of the *Dermestidæ*), in many bugs and water-bugs, and also in many neuropterous insects. That these ocelli are in fact supplemental eyes, appears evident from the experiments of Swammerdam and Reaumur; the latter of whom varnished the back of the head, covering the ocelli, in more than twenty bees, which he then set at liberty three or four paces from the hive, but not one of them knew where to find it again, nor appeared to search for it. They flew at random to the adjacent plants, but never to a distance; and though they seemed to have no difficulty in flying, he never saw them rise in the air as those did whose faceted eyes he had varnished over. The internal anatomical structure of the ocelli also proves that they are distinctly organs of vision.

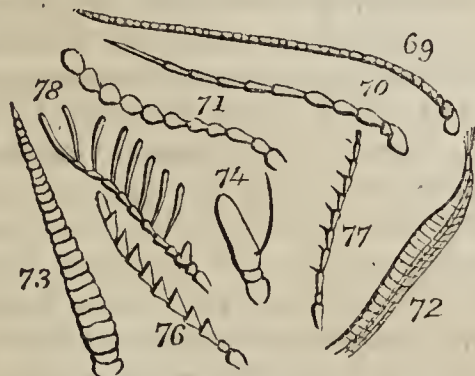
c. The *Antennæ* (a in the figures).

We are now to turn our attention to a pair of organs perhaps the most characteristic of the insect tribes. These are two articulated appendages of a most variable character, affixed at the sides of the head, and generally between the eyes and the mouth. Although occasionally wanting, and generally rudimentary in the preparatory states, these organs are never absent in the imago state. We shall have occasion subsequently to enter into the question of the use of these organs, which have been the subject of much dispute amongst naturalists. It will be sufficient here

to notice that they are exceedingly sensitive, and are evidently of the highest degree of service to the insect. From their great diversity of structure they are employed by entomologists as affording the most satisfactory characters to distinguish the various genera, &c. It is therefore essential that we should enter more into detail respecting their peculiarities. We will therefore describe them according to their various distinctions, and, first, of their situation.

Antennæ are inserted into the head, and connected therewith by means of a ball and socket-like articulation, arising generally in the face between or beneath the eyes; sometimes also, as already described in treating of the eyes, they arise within a notch on the inside of these organs, which are sometimes thereby entirely divided into two parts. They are likewise, as regards their connexion with each other, contiguous or inserted close together, so as almost to touch each other, or distant when far apart; sometimes they arise from a produced part of the head, serving either solely as a peduncle for their support as in the dipterous genus, *Ceria*; or as an elongated rostrum as in the weewils (fig. 56), at the extremity of which the mouth is placed, the antennæ being inserted at its sides; or as a footstalk for the eyes as in *Diopsis* (fig. 60), in which the antennæ are placed close to the eyes; whereas in *Achias* they are frontal, and the eyes pedunculated.

As to their composition, they are formed of a variable number of small and generally cylindrical pieces, externally covered with a horny or leathery integument, according to the general consistence of the body of the insect; and internally softer or vesiculose, having an internal cavity extending throughout the whole length of the organ, inclosing nerves for sensation and muscles for motion; thus forming a series of tubes connected by a membrane, and attached end to end, varying often as to their respective forms, and having generally but a common motion. As to their form, antennæ may be regarded as equal or unequal, according to the equality or inequality in the length of the respective joints: they may also be regular or irregular, accordingly exhibiting a uniform appearance, or having the various joints irregularly constructed. Definitions of a few of the more important modifications of form will be serviceable to the beginner, who would otherwise have to contend against a series of technical names which would be unintelligible to him, unless acquainted with the Latin language, from which they are generally derived.



Variously formed Antennæ.

Filiform, when the antennæ are of equal thickness throughout their whole length, like a thread (fig. 69).

Setaceous, when they insensibly diminish in thickness to the tip (fig. 70).

Moniliform, when they are formed of globular joints resembling a necklace of pearls (fig. 71).

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Cylindrical, when they are of equal thickness throughout, with the joints scarcely discernible.

Prismatic, when they resemble a prism, or are formed of three sides (fig. 72).

Ensiform, angulated at the sides, large at the base, but gradually terminating in a point, like a sword (fig. 73).

Subulata, short and pointed at the tip.

Fusiform, narrowed at the two extremities and thickened in the centre, like a spindle.

Aristate, when the antennæ are terminated by a fine bristle (fig. 74).

Dentate, when the joints are armed with short spines (fig. 77).

Serrate, when the joints are triangular, one of the angles being internally produced, like a saw (fig. 76).

Pectinated, when the joints are furnished with a long and slender tooth, generally arising from the base or extremity of each, thus resembling a comb (fig. 78).

Bipectinated, when each joint produces two long teeth, or filaments.

Flabellated, when the branches are very long and flattened like the rays of a fan (fig. 78 beneath).

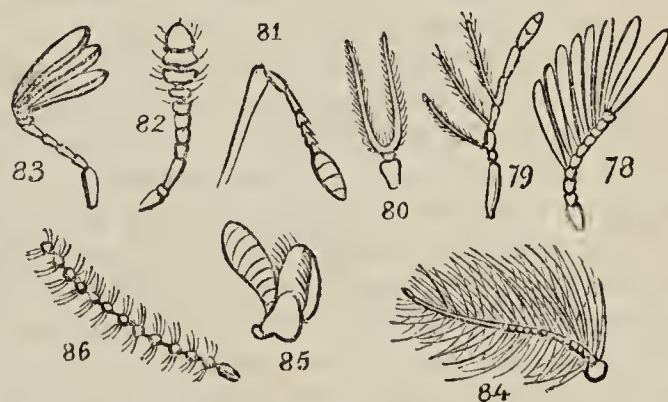
Ramose, when several of the joints throw out branches (fig. 79).

Furcate, when the antennæ are divided into two branches like a fork (fig. 80).

Geniculated, when they are bent at an angle, generally at the extremity of the long basal joint, like an elbow (fig. 81).

Clavate, when they gradually thicken to the tip like a club (fig. 82).

Capitate, when they are terminated by a knob-like mass or head.



Perfoliate, when the terminal joints of the club are not closely applied to each other.

Lamelliform, when they are terminated by a club greatly produced on one side, the joints of which form plates applied against each other (fig. 83).

Fissile, when they are terminated by a cleft knob.

Plumose, when they resemble a feather (fig. 84).

Auriculate, when one of the basal joints is dilated into a shield or ear partially covering the rest (fig. 85).

Palmated, when the antennæ are short, and divided by deep incisions.

Nodose, when they are thickened in various parts, like knots.

Verticillate, when whorls of hair are placed at equal distances upon the joints (fig. 86).

Fasciculate, when a bundle of hairs is placed on one side of each joint.

Scopiferous, when a single or very thick bundle of hair is placed upon one of the joints.

H H H

As to their size, antennæ are exceedingly variable, as they are also in their length, being sometimes shorter than the head, and at others several times longer than the entire body; in many instances they are as slender as a hair, and at other times nearly as thick as the body. As to their direction, they are generally porrected in front of the head; others throw them over the back; in some they are stiff, in others flexible; they are straight, deflexed, or spiral, and are often, when at rest, lodged in particular cavities prepared for their reception on the under side of the head or thorax.

The number of joints of which these organs are composed, merits a few observations. Coleopterous insects have in general eleven joints; the *Heteroptera* from four to six; the stinging *Hymenoptera* twelve in the females and thirteen in the males; but in the *Lepidoptera*, *Ichneumonidæ*, *Orthoptera*, and many others, the number of the joints is much more considerable, sometimes reaching fifty or sixty; and in some *Orthoptera* the number is much more numerous.

In a few insects the antennæ are very short and destitute of joints, as in the *Hippoboscidæ*, and in Dalman's genus *Articerus*; *Bi-articulate* (two-jointed) antennæ are found in *Paussus*, triarticulate antennæ in many *Diptera*. The large sawflies (*Cimbices*) vary in the number of their joints from five to eight.

It still remains to be noticed, that a very great diversity often exists in the structure of the antennæ in the opposite sexes of the same species; this is especially noticed in the greatly increased length of these organs in the males, and in the various hairs, feathers, or branches with which they are adorned in this sex. Numerous other variations occur, such as the inerrassation of certain of the joints, or their greater development, to enumerate which would occupy too great a space; but in all which these advantages are always in favour of the male sex.

d. *The Mouth**.—(M in the figures).

If the structure of the antennæ has required a considerable portion of our attention, a still greater share must be now devoted to the various and variable organs of which the mouth of insects is composed, since it is upon these variations that the most valuable arrangements of insects hitherto proposed, have, in a great measure, been established. If a beetle and a butterfly, a house-fly, or a bug, be examined whilst feeding, a totally different apparatus will be found in each, although perfectly adapted for the mode of feeding. The beetle is employed in gnawing and tearing in pieces hard or fleshy substances: its instruments of manducation are therefore horny and robust. The butterfly, on the contrary, has to suck its food at the bottom of the tubes of flowers, and here in the glowing beams of the sun it revels in its existence, and sips the most delicious nectar. It is necessary for this purpose that it should be provided with a long and slender instrument; but, from the very structure of this apparatus, it is essential for its defence, that so soon as the insect has ceased feeding, the instrument should be lodged in a place of safety. It is therefore rolled up in a beautiful spiral direction and laid to rest between a pair of hairy appendages

which will defend it from injury. If we observe a common fly sipping up a drop of spilt wine, or reveling upon a morsel of sugar, it will be found that its mouth is totally unlike either of the former, it is short, thick, and fleshy, and acts as a sucker, the nutriment ascending through the canal which runs upwards into the throat. The disgusting bug, and all its brethren, have a mouth still differently constructed, being a long and slender-jointed canal of a fleshy or leathery substance, but furnished internally with several slender bristles, which the insect employs as lancets to wound its prey. In the flea again the structure is quite different.

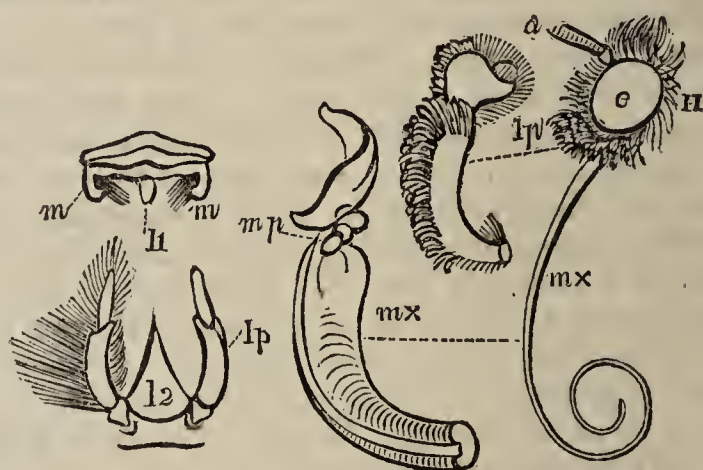
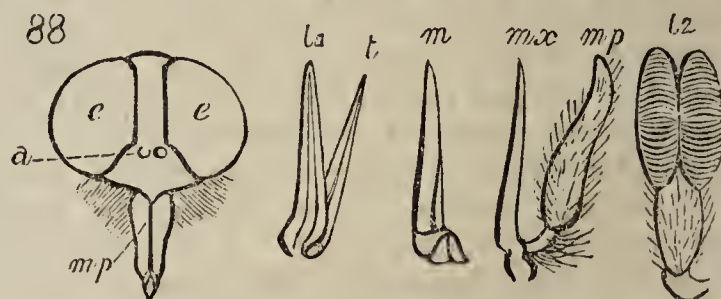


Fig. 87 Antlia of Lepidoptera (Sphinx).

These insects may be cited as affording examples of the chief variations which occur in the general structure of the mouth, and to each of which, as a variation of the mouth, a name has been applied. Thus the mouth of the butterfly and other lepidopterous insects (fig. 87), is termed by Kirby and Spence antlia; by Fabricius lingua (an evidently exceptionable term, being only strictly applicable to a single organ of the mouth); and by Latreille, spirignatha. The mouth of the fly (fig. 88), is termed by Kirby and



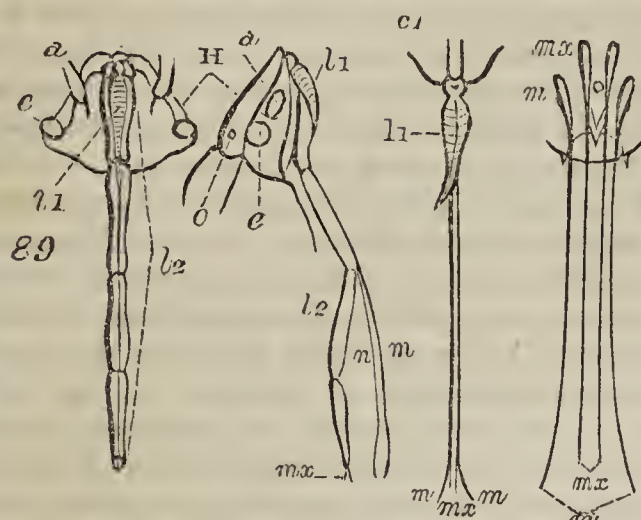
Proboscis of Diptera (Tabanus).

Spence, Linnæus, and Fabricius, proboscis. The mouth of the bugs (fig. 89) is denominated by Kirby and Spence, a promusculus; but by Fabricius, Olivier, and Latreille, rostrum, a term more properly applicable to those insects which have the head produced in front into a beak or snout, as the weevils or scorpion-tailed fly (*Panorpa*), but which latter Latreille, for distinction, terms proboscirostrum. The mouth of the flea is termed a rostrulum, by Kirby and Spence; and rostellum, by Latreille, the latter name having been proposed by Kirby and Spence for the suctorial organs of the louse tribe (*Pediculidæ*), but which Latreille terms siphunculus. Moreover, the mouth of the bee, which is chiefly organised upon the same plan as the biting mouth of the beetle, but has its parts elongated so as to lap up the honey of flowers, is termed by Latreille a *Promusculus* (although that term had been given by Kirby and Spence to the mouth of the bug tribes).

Throughout this great variation of structure, however, the strictest uniformity is maintained, the same

* Obs.—In the various figures representing the mouth of insects, the same letter indicates the same organ throughout; l1, is the upper lip, labrum; m mandible; mx maxilla; mp maxillary palpi; c chin or mentum; l2 labium, or lower lip, lp labial palpi; t tongue, lingua or paraglossæ.

number of parts existing in all, although occasionally rudimental or modified in various degrees, so as to

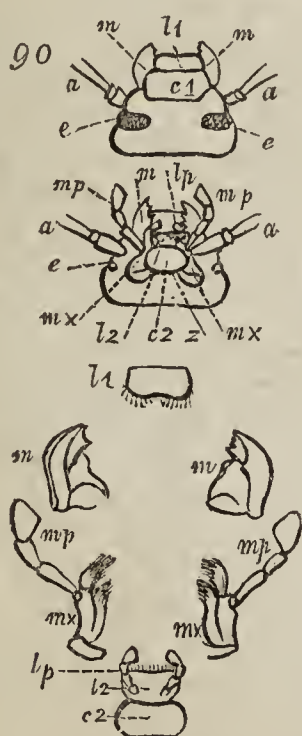


Promuscis of Hemiptera (Pentatoma).

correspond with the functions which they have to support. As, however, these modifications of structure are permanent throughout entire groups, serving, in fact, for the establishment of orders, according to some authors, it would surely be absurd to deny the propriety of assigning to each variation a distinct and fixed name.

The mouth of the hexapod winged insects being thus composed of a certain number of parts, may much more easily be referred to one general type of form, than the mouths of the other annulose animals, some of which have a much more complicated organisation of the mouth than is to be found in insects; thus in the crabs we find not less than five pairs of jaws, whereas there are but two pairs of these organs in insects.

The parts of which the mouths of all insects is composed, may be reduced to six; namely, four lateral pieces disposed in pairs, and two other organs opposed to each other, but in an opposite direction, and which meet each other, so as to close the mouth



The different parts of the mouth of a beetle (Blaps). *l 1*, upper lip; *m*, mandibles; *m x*, maxillæ; *m p*, maxillary palpi; *c 2*, chin or mentum; *l 2*, labium; *l p*, labial palpi.

from above and below; the upper one being placed above the upper pair of lateral organs, and the lower one below the under pair of lateral organs.

As regards the mode of taking their food, insects have been divided by many authors into two groups; namely, those in which the mouth is furnished with mandibles fit for biting, and those in which the mouth

is suctorial. All the various modifications of form to which we have above alluded may be referred to one or the other of these sections; and it is upon this character that the leading division of insects into *Mandibulata* and *Haustellata* has been adopted by various authors; although, since in one period of an insect's life its mouth is fitted for biting, and in another for sucking honey (as in butterflies), it may perhaps be alleged that too great a weight has been assigned to the structure of the mouth. The jaws of biting insects have a horizontal motion; the mandibulated insects must, of course, be characterised by the horizontal motion of their jaws, and not as might, perhaps, from the names of the two groups, be supposed, upon the presence of mandibles in the *Mandibulata*, or their absence in the *Haustellata*; because, as we have already said, the mandibles or their representatives are to be found in all insects. It would, indeed, perhaps be advisable to propose other terms in lieu of these, but as they are generally understood, we shall continue to speak of the mandibulated and haustellated insects, when we would distinguish them by the biting or sucking mode in which they take their food.

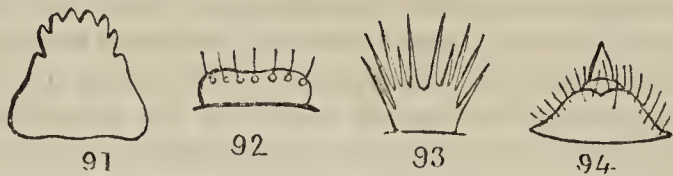
Moreover, instead of treating of these two groups separately, as has been generally done, it will perhaps be more advantageous, as enabling us more readily to show the modifications, which each organ undergoes, to take the various organs seriatim—prefacing their description by the following general observations.

In biting insects, or those which feed upon solid matters, the four lateral pieces perform the office of jaws, and move in a horizontal direction, the two other pieces being regarded as lips; the upper jaws are more particularly denominated *mandibles*; and the lower jaws are named *maxillæ*, and, in general, each of the latter is furnished with a slender-jointed appendage termed a *palpus*, which is never found attached to the mandibles of winged insects; in some annulose insects the mandibles are, however, also palpigerous. The *maxillæ* are generally terminated by two lobes, the outer one being very variable in form. The upper lip is termed the *labrum*, and the lower lip *labium*; but the latter is a much more complicated instrument than the former, and is furnished, like the *maxillæ*, with two short articulated palpi.

In the sucking insects, the nutriment being essentially fluid, the necessity for biting jaws is obviated. They are therefore either obsolete or they assume the form of lancets, and as such have a motion quite different from that of the jaws of biting insects. The mouth of these insects exhibits two distinct modifications of form. In the first, the four lateral pieces, or the mandibles and maxillæ, are converted into slender, setiform, or lancet-like pieces, forming a kind of sucker, which is received into a membranous conical or cylindrical and articulated gutter, as in the bugs; or are lodged within a thick, elbows, and fleshy sheath, as in the flies. In the second modification, the upper lip and the mandibles are either obsolete or but very minute; the lower lip is no longer a distinct and loose organ, but is attached to the head, and is distinguished only by a pair of large palpi; the maxillæ, on the contrary, are greatly elongated, but very much attenuated, being transformed into two tubular threads, which, uniting at the edges, form a kind of sucker, generally rolled up in a spiral direction, and furnished at the base with two minute palpi. We will now

take the organs of the mouth seriatim, according to their position, commencing with that which lies uppermost, or,

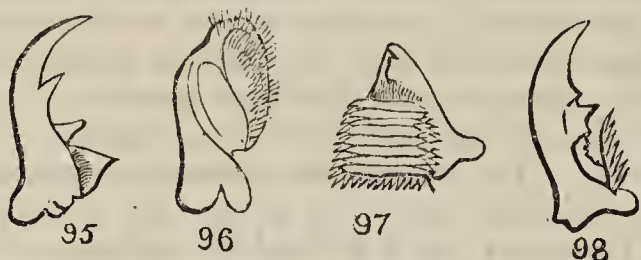
The Labrum or upper lip (*l l* in the figures).—This organ is, in biting insects, a horny or leathery flattened plate of variable form, attached, by an articulation, to the clypeus, and serving as an upper covering to the



Figs. 91, Labrum of *Megacephala*; 92, ditto of *Aploa*; 93, *Perilampus*; 94, *Banchus*.

rest of the mouth; unlike the lower lip, this organ is never furnished with palpi. In many insects, however, it is quite membranous, and is in such cases completely concealed by the clypeus, with which, indeed, it was sometimes confounded by Fabricius, who also gave to it the name of that part. It is generally fringed with hairs. In some few *Hymenoptera* it is furnished with a slender appendage, to which indeed Illiger applied the name of *labrum*. In the *Hemiptera* the upper lip is in the form of an elongate triangle, which falls upon the base of the canal of the lower lip. In the *Lepidoptera* it is so minute as not to be discernible without great care, appearing as a small triangular piece extending downwards towards the base of the labial palpi. In the *Diptera* it is either obsolete, or exists in the shape of a corneous slender gutter, hollowed beneath, and receiving the other slender lancet-like organs.

The Mandibles, or upper jaws (*m* in the figures).—These organs, in the generality of biting insects, are the chief instruments by which the food is bitten into

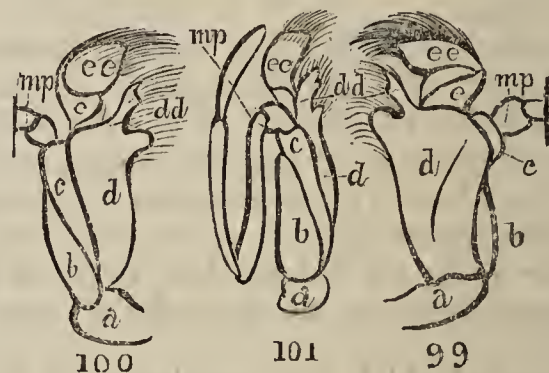


Figs. 95, Mandibles of *Therates*; 96, ditto of *Hyboma*; 97 ditto *Mimela*; 98, ditto *Goerius*.

pieces. They have been considered analogous to the jaws of the higher animals, but they have a much greater resemblance to a pair of large and robust, horny, and notched teeth. They are inserted at the sides of the oral aperture immediately below the lower lip, to which, indeed, they appear to bear the same kind of relation as the lower jaws do to the lower lip. They are composed of a single piece, and are destitute of any appendage. In some of the *Brachelytra* (especially the species ordinarily termed the devil's coach horse, fig. 98) their inner surface is, however, furnished with a small moveable exarticulate process, as is also the case in *Passalus* and *Hydrous*. By Linnæus they were termed *maxillæ*. In beetles these organs are generally of large size, and of a horny substance. The large and powerful instruments with which the head of the stag-beetle is armed are the mandibles immensely developed; but these organs, like many others, exhibit great variations according to the sexes. In the last-named insect for instance, the jaws of the females are so short that this sex was long regarded as a distinct species. They are usually symmetrical, but in many cases are dissimilar in form, and more particularly in the structure of the teeth, with which

they are commonly furnished. In some of the lamellicorn beetles, the internal base of these organs is dilated into a broad and flattened square plate, having numerous transverse ridges, serving for the purpose of bruising the leaves upon which these insects feed (fig. 97). In some beetles also, which subsist upon the juices of flowers, or upon the flowing sap of wounded trees, &c., the jaws are of a membranous structure, and quite unfitted for mastication. In the *Hymenoptera* also, the jaws, although of the ordinary form, cannot, in many cases, be regarded as masticating organs, but appear solely to be employed either in the construction or the provisioning of the nest. In the *Lepidoptera* they are very minute, membranous, and triangular, and placed on each side of the labrum. In the *Hemiptera* they are very long, slender, and employed in conjunction with the maxillæ as lancets. They have also the same character in the *Diptera*; but here they are often entirely wanting. They are, however, particularly distinct in the gnats and gadflies (*Tabanidæ*) fig. 88, *m*.

The Maxillæ, or lower jaws (*m x* in the figures).—These organs are two in number, and are placed beneath



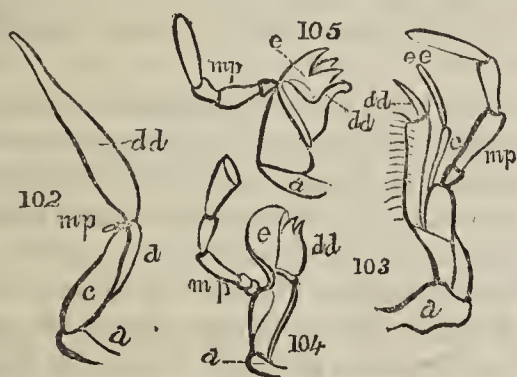
Figs. 99, Maxilla of the great water-beetle (*Hydrous piceus*) seen from above; 100, from below; 101, from the back.

the mandibles, from which they differ in their less firm consistence and more complicated structure, being formed of several parts, and especially by the possession of a slender articulated appendage or palpus, attached to each. They appear to be more especially connected with the lower lip, serving, in some instances, as a sheath for its defence; in the beetles, however, they are generally quite detached. In a table of the comparative variation of the chief insect organs, Mr. Mac Leay has shewn that the maxillæ are less liable to vary than any other; hence it is important to note the modifications to which they are subject.

The maxillæ appear typically to consist of five pieces, exclusive of the maxillary palpi, at least those maxillæ which are the most complicated in their structure, exhibit this number of parts. They are the cardo or hinge (figs. 99, 100, 101 *a*), a most appropriate term, designating a transverse horny piece by which the jaw is affixed within the mouth by membranes. Strauss calls this the *branche transversale*. Savigny the support, Burmeister the base, and Newman the insertio. This piece is especially distinct in beetles and bees. The two following pieces (*b* & *c*) are closely soldered together, and compose the horny pillar between the basal hinge and the terminal lobes. Of these two parts, the external portion (*c*), as first noticed by Latreille, and since named *la pièce palpifère* by Strauss, and the *squama* by Burmeister, bears at its extremity the maxillary palpus (*f*); the internal or dorsal piece * (*pièce dorsal* of Strauss-Dürckheim, *b*)

* Mr. Newman appears to restrict the term maxillæ to this piece.

occupies the space between this and the membrane which runs parallel therewith, forming the basal part of the internal terminal lobe (*d*). Conjointly these three pieces (*b*, *c*, & *d*) are termed the stipes or stalk of the maxillæ by MacLeay and Kirby. The last of these, or the fourth piece of the maxillæ (*d*), is more important, extending not only along the internal side of the maxillæ, but extending often considerably beyond the former pieces, and being very variable in its form; its terminal portion (*dd*) has been named the internal lobe of the maxillæ by MacLeay and others, but it is not distinct from the basal part (*d*). In the predaceous beetles it is long, slender, curved at the tip, and internally clothed with fine hairs or bristles, and sometimes terminated by a hook, which is occasionally articulated, as in the tiger-beetles.

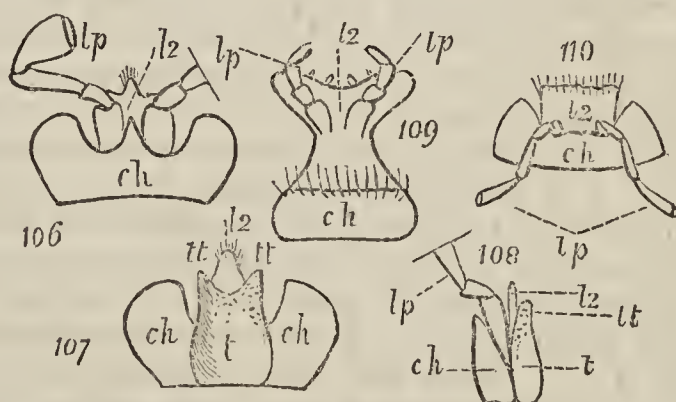


Figs. 102, Maxilla of *Cicindela*; 103, ditto of *Bombus*; 104, ditto of *Blatta*; 105, ditto of *Melolontha*.

This part is termed the *piece intermaxillaire* by Strauss-Dürckheim, and lacinia by MacLeay. In some biting insects it is of a very large size, as in the bees, in which it forms the sole terminal lobe of the maxillæ (fig. 103); in many instances, however, it is greatly reduced in size, not extending beyond the base of the palpus, in which case another organ is developed at its expense, which, as in the large water beetle (*Hydrous piceus*), joins the terminal part of the maxillæ (figs. 99, 100, 101 *e*). In the predaceous beetles this external lobe, as it is generally called, is often of equal size with the terminal portion of the lacinia, or the internal lobe, and is here articulated both at its base and in the middle (fig. 102 *ee*), and is generally termed thence the internal maxillary palpus. In the order *Orthoptera*, this same outer lobe is equally developed, but is not articulated, except at the base (fig. 104); its inner surface is somewhat hollowed, so that it falls upon the terminal lobe of the lacinia, and defends it laterally. It is hence termed by Fabricius the galea, a term applied theoretically by Strauss-Dürckheim to the outer lobe of the maxillæ of all insects. In many insects the two lobes are soldered together into a large flattened membranous plate; numerous other variations of form occur in these two lobes, which, from their situation, are necessarily the part most serviceable to the insect, and consequently modified and adapted to the functions and habits of each of these variations; perhaps the most remarkable are those exhibited by some of the leaf-devouring lamellicorn beetles, in which the extremity of the lobes are very broad, horny, and armed with several strong teeth, having somewhat the appearance of a large double tooth (fig. 105), and by some other beetles which feed upon the pollen or honey-flowers, and in which the outer lobe of the maxillæ are nearly half the length of the body. In the stag-beetles it is prolonged into a fine pencil of hairs, serviceable in licking up flowing sap. It is at the external extremity of the stipes, and intermediate between

it and the base of the outer lobe of the maxilla, that the palpus (for *mp*) of each maxilla is attached. This is a slender appendage, somewhat similar in its construction to the antennæ, but much shorter, and composed of fewer joints, varying in the latter respect from one to six articulations; the latter number is often found in the *Hymenoptera*, but in the *Coleoptera* four appears to be the prevalent number. In the *Orthoptera* and *Trichoptera* it is generally five. These palpi vary very considerably in the size and form of their respective joints, although they are generally slender and filiform; hence they are eminently serviceable in characterising genera, now that naturalists have discovered that smallness of size does not form an objection to the value of the characters derived from an organ. In the suctorial mouth, the maxillæ are still important organs, although completely changed in the structure; thus, in the *Lepidoptera* (see fig. 87), they constitute the two long and very slender instruments which compose the tubular and, when at rest, spiral apparatus, which the insect employs for collecting honey. That these instruments are really modified maxillæ is proved by the modifications which these organs undergo, even in the biting insects, and likewise by the possession of a minute palpus attached to each at the base, which in most *Lepidoptera* is so small as to be easily overlooked, being concealed by the hairs of the labial palpi; in other moths, especially in some of the *Pyrulidæ*, they are, however, very distinct; and hence these insects are ordinarily described as having four palpi. In the *Diptera* and *Hemiptera* the maxillæ are horny, setiform, or lancet-shaped. In the former order they are sometimes almost obsolete, and are generally furnished with a palpus, varying in the number of its joints from five to one, but in the latter they resemble the mandibles, and are not palpigerous. In the flea they are dilated and palpigerous. In the *Trichoptera* they are rudimental, but furnished with long palpi.

The Labium, or lower lip.—We have now arrived at a very complicated organ, which generally serves to

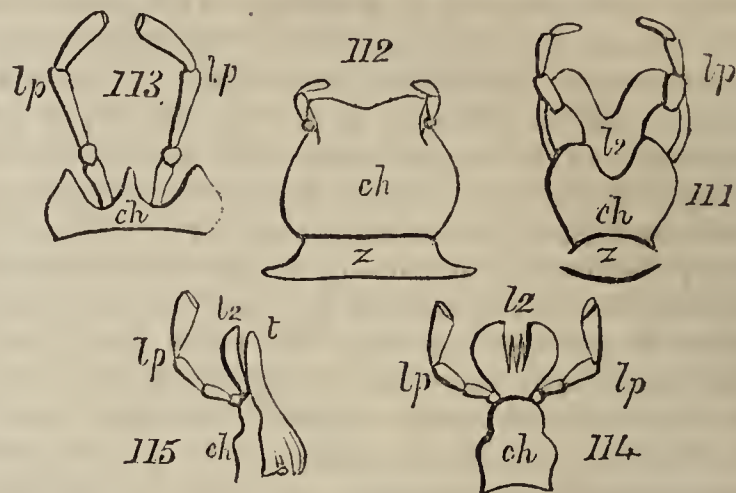


Figs. 106, Labium of *Carabus* outside; 107, ditto inside; 108, ditto laterally; 109, ditto of *Necrophagus*; 110, ditto of *Dytiscus*.

close the mouth from beneath, and therefore corresponding with the upper lip. This organ, if regarded analogically, with reference to the structure of the mouth of other annulose animals, appears to be composed of a pair of maxillæ, united together internally, furnished with a pair of palpi, and covered, in a great measure, by a large horny plate, which is generally termed the mentum. The parts of which this organ is composed are numerous, and the greatest confusion has arisen in the works of authors, as to their nomenclature, owing to the numberless modifications which they undergo, whereby the relative proportions and the consequent relations of the various parts with each other, and with the head, are greatly altered. On

examining the under side of the head of a beetle, the parts of which this lower lip will be found to consist are, first, a broad horny plate (*ch* or *c 2*) articulated at its base, and connected at its extremity by membrane, with a leathery piece (*l 2*), within which arises a fleshy organ (*t*), occasionally having its anterior angles elongated (*t t*); the labial palpi (*l p*) take their rise between the first and second of these pieces. The first named piece is attached to the head by a horny piece (*z*), which, although apparently articulated in some beetles (as for instance in the cock-chaffer, the common Chinese *Mimela*, &c.), is immovable, and forms a portion of the throat or jugulum, but which MacLeay regards as part of the lower lip, and calls it stipes. It is the *piece prebasilaire* of Strauss-Dürckheim. Mr. Newman calls it mentum and insertio, and regards it both as a terminal part of the throat, and as a basal part of the lower lip; at least if we understand him correctly, which it is certainly difficult to do, from the abrupt manner in which his definitions of these organs of the mouth are drawn up. The chin, or mentum (the broad horny piece above-mentioned), is very variable in its form (*ch* or *c 2*), sometimes, as in the lamellicorn beetles, serving exactly as a lower lip, and closing the mouth; but in other beetles it is shorter and more transverse, and cannot be in the least degree effectual in performing this office. Sometimes even its base is soldered to the jugulum, the stipes being entirely obsolete, and thus, in fact, becoming the anterior edge of the former. This is the case in *Paussus*, *Siagona*, &c.; but its true nature may be known by the position of the labial palpi, which always arise between its extremity and the base of the terminal portion of the lower lip, to which (if with MacLeay, Kirby, Curtis, &c., we continue the analogy with the human face), we must restrict the name of lower lip or labium, although the same name is applied to the whole apparatus. This difficulty may be obviated by terming this piece, with Fabricius and others, ligula. The latter piece is more membranous, and of a smaller size than the mentum, and often serves to close the mouth as effectually as the former. We therefore see no sufficient reason, on this account, for not giving to it the name of the labium, or lower lip. The form of this organ is very variable, and sometimes, as in the tiger-beetles, it is completely concealed by the mentum. On examining the lower lip, internally, a distinct membranous or leathery lining (*t*) will often be found, the angles of which are protruded beyond the front margin of the lower lip, in the form of little protuberances (*t t*). These are very conspicuous in many *Carabidæ*, and are termed paraglossæ, although they can only be regarded as the produced angles of the internal organ, which, from analogy, may be termed the lingua, or tongue, and which is very distinct in many orthopterous, and some neuropterous, insects; in which orders the general structure of the labium (and its various parts) is very similar to that of the beetles, except that in the former, the part to which we have restricted the term labium (or ligula) is divided, longitudinally, into four branches. In the *Hymenoptera*, however, the labium has reached its fullest development; and this is more especially the case in the bee tribes, to which (without going through the other hymenopterous families) it will be advantageous to direct our attention. We have said that in these tribes the maxillæ co-operate with the labium, in order to enable the insect to suck the nectar of flowers.

The machinery by which the lower parts of the bee's mouth (to which, from analogy, the term tongue is



Figs. 111, Labium of *Geotrupes*; 112, ditto of *Melolontha*; 113, ditto of *Cicindela*; 114, ditto of *Gryllus* outside; 115, ditto laterally.

often, but not very correctly, applied) are protruded, is exceedingly beautiful. It has, however, already been described at length in our article, BEE. On referring to vol. I, p. 361, col. 2, the maxillæ, and their very minute palpi, will be observed to be extended on each side of the central piece, which, it will be seen, arises from a short triangular piece, which appears analogous to the part which we have noticed above, as the stipes of MacLeay, although here, for evident purposes, it is articulated and moveable. The next piece is the thickened horny tubular piece, or mentum, at the extremity of which arise the labial palpi, remarkable for the elongation of the two basal joints, and between which, at the base, are two short processes, which are termed paraglossæ; the apparatus terminating in a long and slender many-ringed instrument, which, in the following page, we have called the tongue, or lingua, but its true analogy has not been determined. By some authors it is called the labium.

In the lepidopterous insects, the structure of the mouth, although having a function similar to that of the bee's, is completely altered as to the form of its individual organs. In the latter, the maxillæ and labium conjointly operate in sucking up honey; but in the former (see fig. 87), the maxillæ (*m x*) alone perform this office, the labium (*l 2*) being rudimental, and attached to the head, and only distinguishable by bearing the pair of large palpi (*l p*) which bend upwards, and form the defence of the spiral maxillæ. In the *Diptera* (see fig. 88), on the contrary, as well as the *Hemiptera* (see fig. 89), the labium (*l 2*) is the most conspicuous part of the mouth, forming the elbowed and fleshy, or articulated and membranous, tube or canal, in which the other organs of the mouth are enclosed. In these orders, moreover, the labial palpi are obsolete; great variations occur in these orders, and especially in the *Diptera*, as regards the form of this lower lip; but it would lead us to too great a length were we to notice them more in detail. The forest flies, *Hippoboscidæ*, and the flea, exhibit other modifications of form of the lower lip.

Such are some of the more important organs with which Nature has supplied insects, for the due support of their existence. Of their uses we shall speak more at large when we come to treat of the physiology of insects, when we shall state our reasons for employing the terms antennæ and palpi, which indicate no decided use in preference to that of feelers, which is, by many authors, assigned indiscriminately

to these two kinds of organs. We will, therefore, only observe, that much still remains to be done, before we arrive at a perfect knowledge of the structure of the various organs of the mouth throughout the insect tribes. Savigny has effected much in clearing away the obscurity in which the subject had long remained; but there is still an ample field for the employment of a steady eye and hand, in dissecting, and especially, in delineating the many modifications of form, to which the parts of the mouth have been so fully shown to be subject. Until this have been done in the most careful manner, it will not be easy to arrive at a true knowledge of the mode in which these modifications of form are effected, and which alone will enable us satisfactorily to trace the analogies of the various parts throughout the various orders.

B. *The Thorax, or seat of the organs of Locomotion.* This portion of the body lies between the head and the abdomen, and supports the three pairs of legs; and the two or four wings with which perfect insects are in almost every case furnished.

In the early efforts made by scientific entomologists, to determine the various parts of the body of insects, too much attention was paid to an organ when it happened to be fully developed, too little to the mode in which this development was effected. Thus it sometimes happened, that the same organ received various names, according to its extent of development; and it was not until a rigid attention was paid to the various forms which the same part exhibited in its various modifications, that a fixed nomenclature could possibly be applied. This has been especially the case with the thoracic segments of insects; and it is only within a very few years that entomologists have given any extended attention to this part of the subject, or have endeavoured to introduce a fixed series of names. Audouin, Kirby and Spence, MacLeay, and Burmeister, have especially laboured in this field, in which much still remains to be effected. Linnæus thus described this part of the body which he called the trunk,—“*TRUNCUS*, inter caput et abdomen, pedatus thorace, supra dorso, postia scutello, subtus pectore sternoque.” In his descriptions, however, he applies the term thorax either to the large shield which covers the first thoracic segment in beetles, or to the entire trunk, as in the *Hymenoptera*. This mode of description was, notwithstanding its evident impropriety, and want of precision, adopted by most entomologists. Illiger endeavoured to correct this nomenclature, by giving to the trunk of Linnæus the term thorax, designating its upper part, thorax superior, and its lower surface, thorax inferior. Latreille, and others, divided this part of the body into three distinct sections, the two posterior of which, from bearing the wings, Chabrier united under the name *trunc alifere*, which Kirby and Spence adopted, naming these two segments alitrunk; and the first segment, which bears the fore legs (which these authors rather regard as arms or hands), manitrunk. This nomenclature has not, however, been adopted, although Strauss-Dürckheim adopts this division of the thorax, calling the first segment corselet, and the two others the thorax. Most of these authors, however, regard the three segments following the head, as sufficiently separate to require separate names. And the terms prothorax, mesothorax, and metathorax, originally proposed by Nitzsch, have been applied to them; indeed Audouin, MacLeay, and Burmeister, regard

them as segments of equal rank, but as conjointly uniting to form the thorax; whilst Kirby and Spence employ these terms for the upper surface only of the thoracic segments, giving to their under surfaces the names of antepectus, medipectus, and postpectus. MacLeay applies the term tergum to the upper surface, and pectus to the lower; thus we have “tergum of the prothorax, pectus of the mesothorax, &c.” Burmeister, with more uniformity and philosophic acumen, gives the following series of names:—

Thoracic Segment.	Upper Surface.	Under Surface.
1. Prothorax.	Pronotum (T 1).	Prosternum (T 1).
2. Mesothorax.	Mesonotum (T 2).	Mesosternum (T 2).
3. Metathorax.	Metanotum (T 3).	Metasternum (T 3).

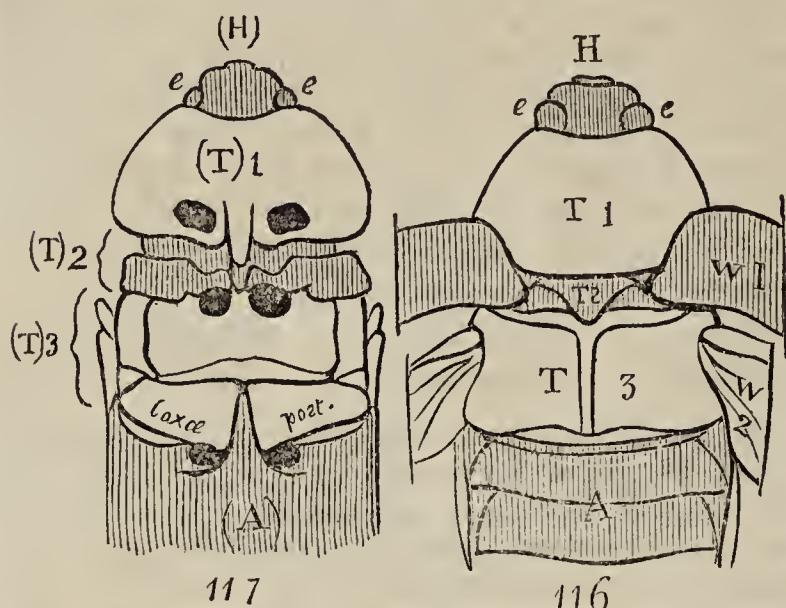
This being the most simple system of nomenclature hitherto proposed for these thoracic segments, we shall adopt it, leaving it optional for our readers to regard the segments, either as entirely distinct, or as conjointly constituting the thorax, or as divisible into two portions, corresponding with the manitrunk and alitrunk of Kirby and Spence. We will only observe that the blunders of unphilosophical describers of insects—who contented themselves, in many cases, with no more anatomical knowledge than would enable them to distinguish one species from another, and who have, consequently, employed names without knowing or caring for their precise meaning—can be no ground for disputing the existence of organs, still less for asserting, as has inconsiderately been done, that the researches of such men as Lyonnet, Léon Dufour, Chabrier, Herold, Strauss-Dürckheim, Savigny, Audouin, and MacLeay, “tend to illustrate a theory, in itself evidently false, rather than to find out and establish plain and solid truths.”

The complicated machinery requisite for the due performance of the two chief kinds of insect locomotion, namely, leg-movements, including creeping, running, swimming, climbing, as well as prehension; and wing-movements or flying, and likewise the great volume required by the organs of motion themselves, have necessarily produced a great increase in the size of the three segments of the body forming the thorax, which in the larva state were but equal in size to the remaining segments; hence we find that the thorax in the perfect insect has become the most robust yet compact, as well as the most complicated in its structure, of all the body segments of an insect. Moreover, the great diversity in the organisation of the wings, and the occasional transfer of wing motion to a single pair of wings, this pair being either the anterior, as in the *Diptera*, or the posterior, as in the beetles, have necessitated a concurrent modification in the form of the thoracic segments according thereto, as well as similar modifications resulting from the varying motions of the legs.

It is further to be noticed, that the many parts of which the thorax is thus composed, were provided by entomologists with separate names, whereby the nomenclature of this part of the body has become very complicated, more especially as the same part has received more than a single name, according to the greater or less degree of its development. This has been more particularly the case in the “Introduction to Entomology,” wherein, although Messrs. Kirby and Spence do not describe much more than twenty of its distinct component parts, about forty different words are used for them in the nomenclature of the thorax. The chapter on Orismology is nevertheless, as Mr. MacLeay observes in the *Zoological Journal*,

"more particularly valuable, and, making allowance for the nomenclature of parts, deserves the special attention of entomological students."

in the perfect insect varies very generally and considerably from what it was in the larva." We have.

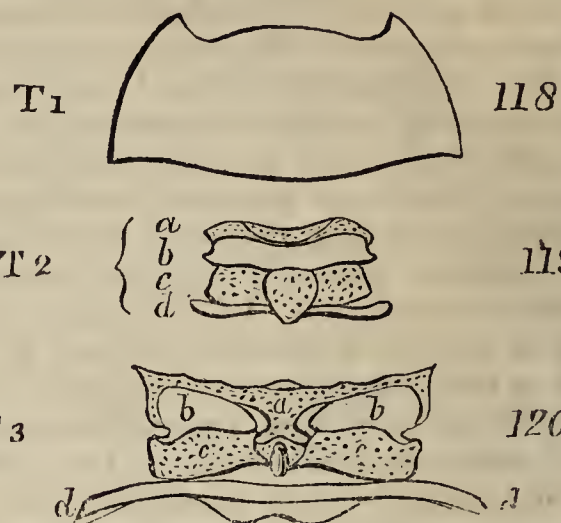


Figs. 116, Upper, and 117, under side of the thorax of a beetle (*Buprestis*), T 1 pronotum, (T) 1 prothorax, T 2 mesonotum, (T) 2 mesosternum, marked with lines to distinguish its boundary, T 3 metanotum, (T) 3 metasternum. H, head; A, abdomen; w 1, elytra; w 2, posterior wings.

Much of this confusion has been obviated by M. Audouin, who, from his admirable comparative investigation of the structure of the segments of the body, ascertained that they were respectively composed of the same essential parts, and consequently that the same series of names might be applied to each. The following is a table of the thorax, as theoretically supposed by him to exist in all insects.

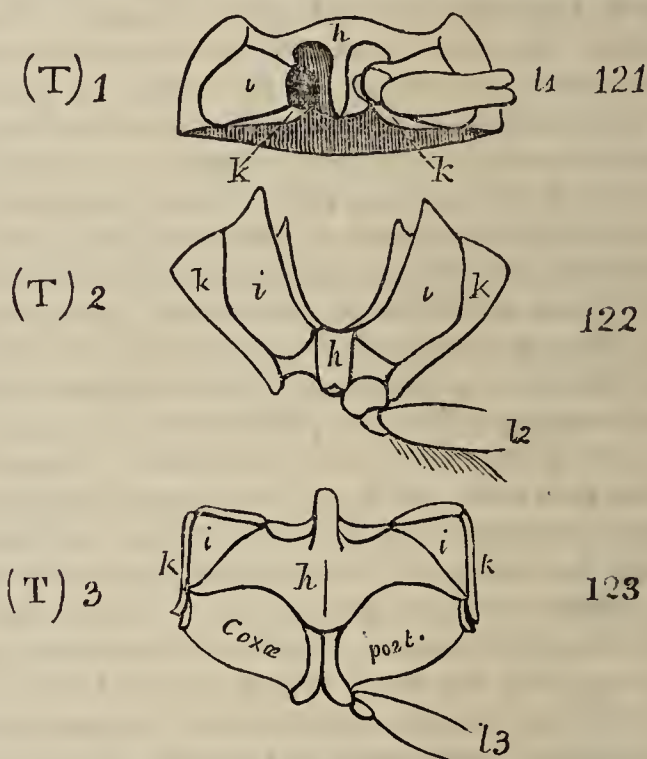
Thorax. (Truncus, Linn., Fabr. and Kirby)	Prothorax. (Manitrunk, Kirby; Corselet, Strauss).	<div> <div>Tergum. (Pronotum, Burmeister; Prothorax, Kirby) T 1.</div> <div> <div>Præscutum. Scutum. Scutellum. Postscutellum.</div> </div> </div>
	Mesothorax. (Meditrunk, Kirby; Prothorax, Strauss).	<div> <div>Pectus. (Prosternum Burmeister. Antepectus, Kirby) (T) 2.</div> <div> <div>Sternum. or h 1 Episterna. 1 or 1 1 * * * Epimera. k or k 1</div> </div> </div>
	Metathorax. (Protrunk, Kirby & Sp.; Metathorax, Strauss.)	<div> <div>Tergum. (Metanotum Burmeister; Metathorax, Kirby.) T 3.</div> <div> <div>Præscutum a or a 3 Scutum. b or b 3 Scutellum. c or c 3 Postscutell. d or d 3</div> </div> </div>
		<div> <div>Pectus. (Mesosternum, Burmeister; Medipectus, Kirby) (T) 2.</div> <div> <div>Paraptera. Sternum. h or h 2 Episterna. 1 or 1 2 Epimera k or k 2</div> </div> </div>
		<div> <div>Furca, called Antefurca.</div> </div>
		<div> <div>Tergum. (Mesonotum Burmeister; Mesothorax, Kirby) T 2.</div> <div> <div>Præscutum a or a 2 Scutum. b or b 2 Scutellum. c or c 2 Postscutell. d or d 2</div> </div> </div>
		<div> <div>Pectus. (Mesosternum, Burmeister; Medipectus, Kirby) (T) 2.</div> <div> <div>Paraptera. Sternum. h or h 2 Episterna. 1 or 1 2 Epimera k or k 2</div> </div> </div>
		<div> <div>Furca, called Medifurca.</div> </div>
		<div> <div>Tergum. (Metanotum Burmeister; Metathorax, Kirby.) T 3.</div> <div> <div>Præscutum a or a 3 Scutum. b or b 3 Scutellum. c or c 3 Postscutell. d or d 3</div> </div> </div>
		<div> <div>Pectus. (Metasternum, Burmeister; Postpectus, Kirby.) (T) 3</div> <div> <div>Paraptera. Sternum. h or h 3 Episterna. 1 or 1 3 Epimera. k or k 3</div> </div> </div>
		<div> <div>Furca, called Postfurca.</div> </div>

"It must not be imagined, however," observes Mr. MacLeay, "that the pieces of the thorax mentioned in the above table are all perfect and distinct in every insect. Pieces of the thorax may disappear, being evanescent owing to the great development of the contiguous segments, or by being confluent or soldered together with the next adjoining pieces. To know the pieces which are thus lost, it might be thought that on comparing the larva with the perfect insect, the position of the stigmata (spiracles) ought to afford some clue, but in truth these are unsafe guides; as it is well known that the situation of the stigmata



Figs. 118, pronotum; 119, mesonotum; 120, metanotum of a *Dyticus*. In 118 the subsegments are confluent. In 119 and 120 the alternate subsegments are dotted to show their extent.

indeed found a clue for getting out of the difficulty above-mentioned, but from the little attention hitherto paid to the subject, another difficulty of a not less formidable but of a far more philosophical kind has presented itself, namely, that of proving, by careful study, the relations of the several parts in the different orders, and the variations they are subject to.



Figs. 121, prosternum; 122, mesosternum; 123, metasternum of a *Dyticus*.

The total number of parts in the thorax, according to Audouin, amounts to thirty-six; but if the simple pieces, as the sternum, &c., be supposed to be divided by the medial line, the number will be fifty-two; and Mr. MacLeay, by supposing that each of the three sterna consists, like the terga, of four transverse pieces similarly divided by the medial line, causes the whole number of pieces in the thorax to mount up to seventy-two. Authors, however, who have looked at the composition of the thorax, without having any theoretical views to maintain, have found the really distinct number of its parts much fewer in number than either of the last named authors; thus Chabrier and Burmeister reckon only eighteen, Kirby and Spence twenty, and Strauss-Dürkheim twenty-two. We will now confine our attention successively to the primary segments of the thorax, and show the chief modifications which they exhibit, and then describe the organs of locomotion.

1. *The Prothorax* (manitrunk, Kirby), T 1 & (T) 1.

—This is the segment which immediately follows the head, and precedes the segment bearing the anterior pair of wings. On its under side it bears the anterior pair of legs. It is generally larger than the head, and smaller or narrower than the following segment; the reason whereof is obvious, since it has only to support one pair of limbs, whereas the following supports two. It is to the upper surface of this piece, when most fully developed, that Linnæus gave the name of thorax. It is named by Kirby prothorax, by Audouin tergum, and by Burmeister pronotum. But the four dorsal pieces are here confluent*, although, as in some locusts, their situation is indicated by transverse impressions across the prothoracic shield.

The size of the pronotum (T) varies very considerably as well as its form; thus whilst in the *Coleoptera*, *Orthoptera*, and heteropterous *Hemiptera*, it is of a very large size and forms a strong horny shield (see figs. 116, 118, T 1), sometimes produced over the whole body, and in others furnished with the most remarkable protuberances, as in many *Homoptera*, lamellicorn beetles, &c. In the *Lepidoptera* and *Trichoptera* it is nearly evanescent, forming in the first of these orders a narrow ring. In some *Hymenoptera* it is more conspicuous, forming, as in *Xyphidria*, a narrow neck, by which the head is attached to the thorax. In this order, the front of the thorax is covered by a narrow plate (see figs. 124, 125, c 1), which often laterally reaches as far as the base of the wings. This is the collare of Kirby, who contends that it ought not to be regarded as a part of the prothorax. MacLeay, Burmeister, and others, however, give it as a portion of that segment, the former considering it as the scutellum of the prothorax, and observing that as these insects are essentially fliers, this piece of the prothorax is employed to add strength to the mesothorax in its support of the upper wings.

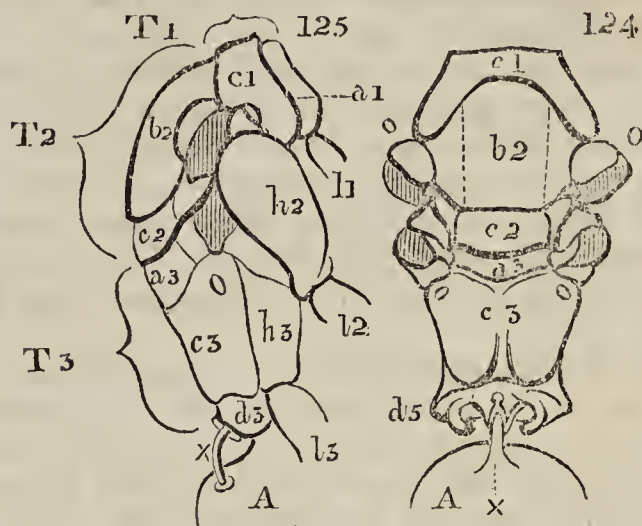
The under surface of the prothorax (T 1) consists of a central piece or prosternum (antepectus, K.), which is generally horny, and extends in a point between the fore-legs, as is especially the case in the spring beetles (Elateridæ), and two lateral pieces which are very distinct in the predaceous beetles. These are the epimera and episterna of Audouin, and sometimes the ora of Kirby and Spence.

In addition to the various horns or protuberances which arise from the prothorax, but which are only continuations of the external crust, there are several distinct appendages to be noticed. Of these, the legs are the most important, the basal piece of which often appears to form a constituent part of the prosternum, but is, nevertheless, moveable; the first pair of spiracles are also parts of the prothorax.

Moreover, in some of the longicorn beetles there is a pair of moveable spines (umbones, Kirby and Spence), arising at the sides of the pronotum; and in lepidopterous insects there is a pair of scales covered with hair, quite distinct from the wing-covers (tegulæ), and which the same authors term patagia,

* Hence MacLeay says, that in all future descriptions the four confluent dorsal pieces of the prothorax (which are almost invariably, at least in the *Coleoptera*, &c.,) described as the thorax by the describers of species should no longer be called the thorax but the prothorax; but this must surely not be correct, since the latter name would imply both upper and lower surface of the first thoracic segment, although the descriptions are applicable only to the tergum or upper surface of this segment. Burmeister has obviated the difficulty by proposing the term pronotum.

or tippets; but which have been overlooked by all other authors except Chabrier, who first discovered



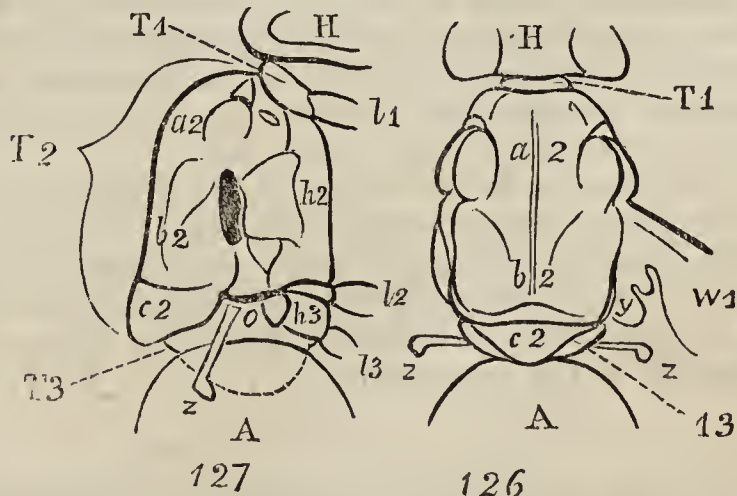
Figs. 124, dorsal view of the thorax of a wasp; 125, lateral view of ditto, lettered as in figs. 118—123.

them, or else confounded (as by Burmeister, p. 77), with the true tegulæ. They are described as vesicles appearing full of liquid and of air, and are placed at the sides of the pronotum.

2. *The Mesothorax.*—(*Prothorax*, Strauss-Dürckheim) T 2 and (T) 2.

This is the second segment of the thorax (or the first of the alitrunk of Kirby and Spence), and bears the anterior pair of wings, or their representatives, and the middle pair of legs. In insects which have the four wings of equal size, the mesothorax and the metathorax, (the following segment), are equally developed; but when, on the contrary, one pair of these organs is more particularly developed, the segment to which it is attached is consequently increased in size. If this pair of wings be the anterior pair, the mesothorax is greatly enlarged, this is, therefore, the case in the *Diptera* (fig. 126), where the mesothorax almost occupies the entire thorax. In the *Hymenoptera* (fig. 124) the second pair of wings exist, but of a smaller size than the fore pair; the metathorax is accordingly more developed than in the *Diptera*, but is smaller than the mesothorax. If we now look at those orders which have the second pair of wings enlarged, we find the mesothorax diminished, and the metathorax increased in size to a corresponding extent; this is the case in the beetles, but most especially in the extraordinary parasitic order, *Strepsiptera*, respecting which so much incorrect matter has been published.

The four pieces of which the upper side of each thoracic segment is typically composed, are sufficiently distinct in the mesonotum; the first, or the præscutum (a 2), (prophragma, Kirby and Spence); and



Figs. 126, dorsal view of the thorax of a *Tabanus*; 127, lateral view of ditto, lettered as in figs. 118—123.

the second, b 2, scutum (or the dorsulum, Kirby and

Spence), are both distinct, but not conspicuous parts in the *Coleoptera*, in which order the third piece, (*c* 2), is very conspicuous *, being the triangular part which is found at the base of the elytra, where they unite together, and is ordinarily termed the scutellum; but more properly the scutellum of the mesothorax or mesoscutellum. Some beetles, indeed, are said to be exscutellated, or destitute of scutellum; and so far as its occupying the ordinary exposed situation is concerned, they are exscutellated; but the same part is to be found in a diminished form in all beetles.

In some few insects, as the scutellata (*Tetyræ*), the scutellum is so much enlarged, that it completely covers the abdomen. The postscutellum of the mesothorax, (*d* 2), or the *frænum* of Kirby and Spence is also distinct, but not very conspicuous, except by dissection.

In insects having the upper wings transformed into horny or leathery wing-covers, the mesoscutellum is very distinct and elevated, being evidently serviceable in giving some kind of support to these wing covers. In insects with membranaceous wings the mesoscutellum is not so conspicuous an organ.

The upper surface of the mesothorax is very variable in its consistence, according to the degree of exposure to which it is subject. Thus in the beetles, where it is almost entirely covered by the prothoracic shield, or by the base of the wing-covers, it is leathery. with the exception of the exposed mesoscutellum. If, on the contrary, it is naked, as in the *Hymenoptera*, *Diptera*, &c., it is more solid in its construction. In the *Diptera* the præscutum and scutum of the mesothorax are soldered together, see fig. 126, (*a* 2, *b* 2), forming the larger part of the upper surface of the thorax; the scutellum (*c* 2) is also distinct. In the *Lepidoptera* the præscutum is small, but the scutum (dorsulum, Kirby and Spence) very large and distinct. In the *Hemiptera*, as in the *Coleoptera*, the præscutum and scutum are covered by the pronotum. In the *Hymenoptera* the scutum and scutellum are similar to those of the *Diptera*.

On the under surface the mesosternum is generally horny, and extends between the middle legs, sometimes as in some *Coleoptera* (*Elateridæ*), having an impression to receive the spine of the prosternum; at other times, as in the *Cetoniæ*, the prosternum itself is produced into a spine extending between the anterior legs.

On each side of mesosternum extend the epimera and episterna of the mesothorax, the former being termed scapularia by Kirby and Spence; they are generally of small size, except in a few instances, such, for instance, as the *Cetoniidæ*, in which the former are very conspicuous, forming the horny plate, intervening on each side between the shoulder of the elytra and the posterior angles of the pronotum.

In addition to the above pieces, the paraptera, or tegulæ, being the small scales at the base of the upper wings (see fig. 124, *o o*), which sometimes, as in some of the *Proctotrupidæ* (especially *Galesus*), are of a large size, must be noticed. They also acquire a large size in the *Lepidoptera*.

The mesothoracic appendages are the anterior pair of wings, the middle pair of legs, and the mesothoracic spiracles. In dipterous insects the base of the wings are often furnished with a membranous scale, termed the alula or winglet, which Kirby and Spence regard as the true analogue of the second pair of wings, and consequently as attached to the metathorax (see fig. 126 *y*).

3. *The Metathorax*, T 3 and (T) 3 (*Protrunk*, Kirby and Spence).

This is the last of the three thoracic segments (or the second of the *thorax* of Strauss, or *Alitrunk* of Kirby and Spence), and bears the posterior pair of wings, or their representatives, and the third pair of legs. Its development and consistence are variable, dependent upon the same principles, already stated to regulate the development of the mesothorax. It consists of the same number of pieces as the preceding segment, the dorsal pieces (composing the metanotum) being the præscutum (mesophragma of Kirby and Spence in *Coleoptera*; postdorsulum of the same authors in *Hymenoptera*), scutum (postdorsulum of Kirby in *Coleoptera*), scutellum (postscutellum and postfrænum of Kirby), and postscutellum (metaphragma, Kirby and Spence). The scutum and scutellum are the most conspicuous parts in *Coleoptera*, being channelled longitudinally. In *Hymenoptera*, see fig. 124, T 3, the mesothorax is reduced in size, and this is more especially the case in *Diptera*, see fig. 126, T 3; but in the parasitic *Strepsiptera*, the forewings are very minute and twisted appendages, and the second pair of wings of very large size, the metathorax being so greatly increased in its dimensions that it may be almost said to constitute the entire thorax.

The under surface of the mesothorax, or the metasternum, is generally a horny covering, divisible, like the metasternum, into various pieces; of these the central metasternum is generally the most enlarged portion; sometimes being produced into a point extending beneath the abdomen, as in *Hydrous*; sometimes it is flat, and occupies nearly the entire under surface of the metathorax; at other times, as in *Dyticus*, the posterior coxæ or basal parts of the hind legs (which are of a large size), are soldered to it, and hence the points of these parts of the hind legs have been often termed the bifid mucro of the metasternum. The sides of this metasternum in the *Coleoptera* are laterally margined by a pair of longitudinal pieces, which are the episterna, or the parapleura, of Kirby and Spence. The construction of the various parts of which the metasternum is composed would require too much minute description to be available in a work like the present; we shall therefore only further notice, that in winged insects having a pedunculated abdomen, Messrs. Audouin and Latreille consider that the piece which terminates the thorax behind is not a portion of the metathorax, but, on the contrary, is the basal segment of the abdomen. This opinion appears to us to have been successfully refuted by MacLeay and Burmeister.

The appendages of the metathorax are the posterior pair of wings, or their analogous organs, the third pair of legs, and the metathoracic spiracle.

It still remains to notice a curious apparatus, consisting of a ligament, which passes through a slit at the extremity of the postscutellum in the pedunculated *Hymenoptera*, (see fig. 124, 125, *x x*), in the middle of which is an elevation of a horseshoe form, having two apparent and one real central apertures. This ligament

* Mr. Newman says, "In all descriptions of *Coleoptera* the mesothorax is termed scutellum." If he had said that in all descriptions of *Coleoptera*, the scutellum is the only part of the mesothorax (or rather of the mesonotum) which is noticed, he would not have misled his readers.

termed by Kirby and Spence the Faniculus, and is serviceable in elevating or depressing the abdomen.

We will now proceed to the description of the *Organs of Locomotion*; these are either wings, or their representatives, or legs.

1. *Wings*, or the organs of aerial progression.

These organs, unlike the wings of birds, consist simply of a double membrane, of a very slender and generally transparent consistence, inclosing numerous nervures or veins of a firmer substance. These nervures are a kind of solid tubes inclosing the tracheæ, or aëriferous vessels in their interior, of which we have already spoken in our account of the escape of the perfect insect from the pupa skin.

These organs undergo very great modifications of form and structure in the different orders of insects; their number is also liable to corresponding variations; we say corresponding, because as one pair of wings is sometimes so completely modified as to be no longer serviceable as an organ of flight, the number of these wings is necessarily reduced from four to two. These modifications occur either in the anterior or posterior pair of wings: thus, in the *Coleoptera*, the fore-wings, although ample, are transformed into a pair of scales serving for the defence of the wings, and unserviceable as instruments of flight. The same occurs in a greater degree in the *Strepsiptera*. In the *Hemiptera* (*Heteroptera*), the four wings are of a leathery structure at the base, but are membranous at the tip; whilst in the homopterous *Hemiptera*, and *Orthoptera*, the upper wings are of a membranous nature, but much thicker than the lower wings throughout. In the *Hymenoptera*, *Neuroptera*, and *Lepidoptera*, all the wings are equally membranous. In the *Diptera* the fore-wings are alone to be found as organs of flight, the posterior wings being reduced to a pair of slender knobbed filaments. There are many cases in which the wings are totally wanting, as in the glow-worm, many *Orthoptera* and *Hemiptera*, &c.; but these are to be accounted only as casual exceptions. The same may be said of many beetles, which have the elytra, or upper wings, soldered together; in which case, as wings would be useless, they are not given to the insect.

The only recorded instance in which the posterior pair of wings have been ascertained to be developed, without there being the least rudiment of the anterior pair, is found in *Perlamorpha hieroglyphica* of Curtis, one of the spectre insects (*Phasmidæ*); also described in the last number of the Zoological Journal, under the name of *Asehiphasma annulipes*.

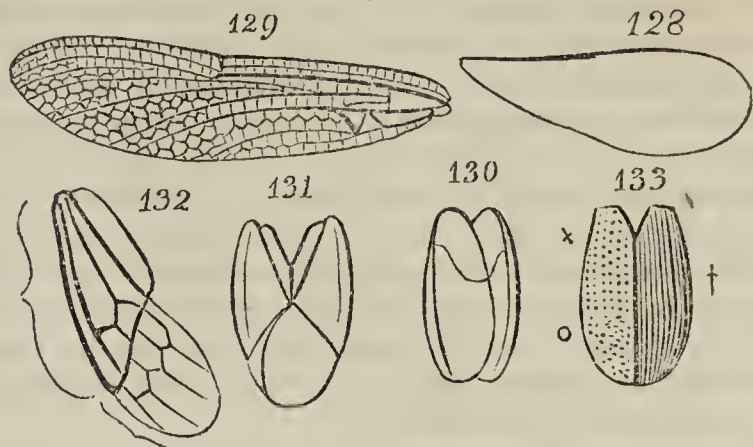
The wings arise respectively from the anterior lateral angles of the meso- and metathorax, articulating with the scutum and episternum, that is, just at the place where the dorsal plates of the meso- and metanotum unite with the lateral plates of the meso- and metasternum.

With respect to their consistence, the organs of flight may be divided thus:—

- a. Membranaceous wings.
- b. Tegmina.
- c. Hemelytra.
- d. Elytra.
- e. Halteres.
- f. Pseudhalteres.

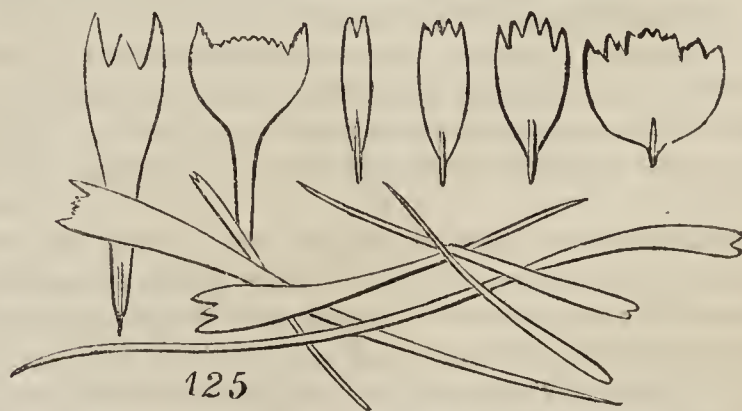
a. *Membranaceous wings*.—It is by means of these membranous appendage, that flight is chiefly effected, the other variations of these organs serving more especially as organs of defence to the true wings. In

their most simple form, as in some of the minute *Hymenoptera*, especially the genus *Psilus* (fig. 128), the



wing consists but of the two layers of membrane, without any visible air-tubes, or nerves, which, in the more advanced structure of the wing, are developed, dividing it into more or less numerous divisions, like the frames of a window. This formation is more and more complete, and the divisions more and more numerous, until we find the wing exhibiting a net work of meshes too numerous to be counted; this is the case with the dragon-fly (fig. 129). In the *Hymenoptera*, and *Diptera*, the wings are essentially similar in the construction; but the nervures, especially of the posterior wings of the former, are less numerous, forming but few spaces, or cells, as they are termed. The second wings of the *Hymenoptera* are smaller than the anterior, whilst in the dragon-flies, and some other neuropterous insects, they are of equal size. If, therefore, we regard the development of wings as the chief characteristic of the *Ptilota*, or winged insects: those species which exhibit the wings of equal consistence and size, must be regarded as the types of the tribe.

The external margin of the posterior wings exhibits, also, in many insects with naked wings, minute hooks for retaining the wings on each side together during flight. These are especially found in the *Hymenoptera*, and are called hamuli. In the lepidopterous insects another structure prevails for the like purpose; the margin of the posterior wing being furnished at its base with a long and curved bristle, which is received into a little hook on the under surface of the anterior wings, in which it plays. The wings in this same order, offer another peculiarity, since, instead of being naked and transparent, they are clothed with a double layer of minute scales, somewhat resembling those with which fishes are covered. These scales, upon which the beauty of lepidopterous insects so entirely depends, are easily detached in the form of a fine dust, which, when examined with the



Feather-scales from the Goat-moth.

microscope, are exceedingly variable in their form, but generally more or less wedge-shaped, or oval; sometimes toothed, or notched, at the broadest end, some having a slender footstalk. The membranous

surface of the wing itself exhibits the appearance, when similarly examined, of numerous minute impressions arranged in lines, in which the base of the scales are planted, being laid upon each other like the tiles on the roof of a house. The derivation of the name of the order *Lepidoptera* (scaly wings), expresses this character. It has been suggested that the form of these scales might be serviceably employed in furnishing specific characters, for the determination of the various species of lepidopterous insects; but this is quite impossible, since scales of every possible form are found upon a single individual, as may be seen from the preceding figures, all of which represent scales from the goat moths.

Here it will be serviceable to notice a few of the more characteristic variations which occur in the markings of the wings of lepidopterous insects (see fig. 134); these are,

Spots (*Maculæ*), which are patches of one colour appearing on the differently coloured wings (134. *a a*).

Dots (*Atomæ*), which are very minute points of a different colour; when scattered over the entire surface of the wings they are said to be irrorate (*b*).

Puncta, gutta, pustula, and plaga, are words used for spots of various sizes.

Lines (*Lineæ*), narrow, generally straight marks of different colour (*c*).

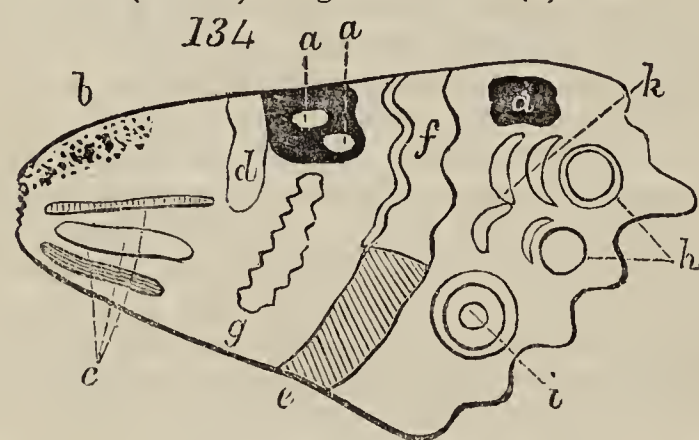
Streaks (*Strigæ*), somewhat broader lines, generally transverse (*d*).

Bands (*Fasciæ*), broad transverse marks (*e*).

Vitta is a longitudinal fascia.

The four last terms are said to be undulated when alternately curved like waves (*f*), and dentated when toothed (*g*).

Annulets (*Annuli*), ring-like marks (*h*).



Imaginary wing of a Butterfly.

Eyelets (*Ocelli*), circular spots upon a differently coloured wing, with the centre also differently coloured (*i*); the latter is termed the pupil (*pupilla*), and is surrounded by the iris.

Lunulets (*Lunulæ*), crescent-shaped marks (*k*).

Adjectives derived from these words are employed in describing lepidopterous and other insects. Thus we have such words as maculated, fasciated, ocellated, &c.

In the caddice flies, the wings are clothed with fine hairs, whence the name of the order given to them by Kirby, *Trichoptera*; the wings of the gnat are also beautifully ornamented with scales along the nerves of the wing. These organs, in a general sense, are of an elongated triangular form, the longest side being the exterior, or anterior, margin; the opposite angle is the posterior, or internal, angle; the side between the base of the wing and this angle, is the basal margin; or, in the posterior wings, the anal margin; the

other side is named the apical, or terminal, margin. There is, however, the greatest diversity in the shape of the wings, especially the posterior pair in the *Lepidoptera*; some are notched, and many terminated by one or more long tails. A small group of moths have been termed *Plumes*, from the wings being divided into numerous feathers, the divisions extending to the base of the wing; some are five-plumed, and others twenty-plumed.

Adjoining the external margin of the wings, at some distance beyond their middle, a callous point is to be observed, formed by the union of the nervures of this anterior or costal margin, which is termed the stigma.

In our article HYMENOPTERA, we have noticed more particularly the formation of the cells, originating in the nervures arising from the stigma, and which have been much employed in distinguishing the various groups of insects. That it is, in certain families highly important, cannot be doubted; but we must not rely implicitly upon it as an absolute character, since many groups, having very different habits, and varying in other important characters, are identical in the neuration of their wings. The credit of having selected these variations in the form of the cells, as affording good generic characters, has ordinarily been given to Jurine, a celebrated Swiss entomologist, who arranged the *Hymenoptera* in accordance therewith. Frisch, however, a German, and Harris, an English author, had long previously made use of the same characters.

In general, membranous wings remain expanded at all times to their full extent, but this is by no means a constant character. Thus in the *Hymenoptera*, the family of the wasps (*Vespidæ*), and the species of the genus *Leucospis*, they are folded throughout their whole length when unemployed. In the *Lepidoptera* the same occurs in the family of the *Plume* moths, already mentioned. The lower wings of orthopterous and homopterous insects, are also longitudinally folded beneath the wing covers; and the wings of coleopterous insects, are folded both longitudinally and transversely when unemployed. The posterior wings of the *Earwig* are similarly folded, the nervures, when the wings are extended, forming a most beautiful object. The position of the wings when shut, afforded to Linnæus the chief character by which he divided the moths into various sections. Thus they were said to be depressed, deflexed, horizontal, extended, divaricate, &c.

Some lepidopterous insects appear to have six wings, and have since been specifically named *Hexapterata*, &c., forming the genus *Lobophora* of Curtis; a name indicative of the real character of the wings, of which the posterior pair are furnished with a large membranous lobe.

It still remains for us to mention a small membranous appendage connected with the base of the wings in the majority of dipterous insects, to which the name of alula, or winglet, is generally given, consisting of two concave and convex membranes united together, and surrounded by a fine fringe, which fold over each other like the valves of a bivalve shell, and upon which we have seen the halteres act, in a manner similar to a drumstick beating on a drum. Kirby and Spence regard them as analogous to the posterior wings; but they are decidedly parts of, and connected with, the large wings. Somewhat similar organs have been noticed in the large water beetle,

Dyticus marginalis; we have also found them equally developed in the *Hydrous piceus*, at the base of the elytra.

b. *The Tegmina*.—This term was proposed by Illiger to designate that variation of wings, in which the substance is intermediate between the true membranous wings and the hard coriaceous elytra. To the substance of which these kinds of wings are composed, Kirby and Spence gave the name of pergameneous, as somewhat resembling parchment, or vellum; and the *Orthoptera* and *Homoptera* are the only insects which exhibit this kind of wing, or rather wing-cover, since the posterior wings in these orders are membranous. From elytra, the possession of very numerous nervures sufficiently distinguishes the tegmina, whilst their thickened substance equally separates them from the membranous wings. Tegmina are also distinguished from elytra by the inner edges, or anal are as folding over each other, instead of meeting in a line down the back (see fig. 130, tegmina of a *Blatta*). Like many (or rather theoretically all) membranous wings, tegmina are divisible into three areas, separated from each other by strong longitudinal nerves; the external or costal, the intermediate, discoidal, or apical, and the anal. The position in which these organs are placed in repose, varies according to the form of the body. Thus in flat insects they are horizontal, but in thick or compressed insects they are deflexed at the sides, sometimes at a considerable angle. We have seen, that in insects having the mesothoracic scutellum very prominent, the anterior organs of flight are more or less horny, and of very little service in locomotion, requiring some kind of support, which is afforded by the scutellum. They are thus circumstanced in beetles, and in the heteropterous *Hemiptera*; but in the tribes in which tegmina are present the scutellum is not a prominent organ; they are therefore more essentially organs of flight than elytra or hemelytra, which we now proceed to describe; commencing with the former, as being intermediate in their formation between tegmina and elytra.

c. *The Hemelytra* (see fig. 131, 132, hemelytron of *Heterogaster urticæ*).—Under this name, Latreille described (Hist. Nat. Crust. &c. ii. p. 164) the anterior organs of flight of the *Cimicidæ*, or heteropterous *Hemiptera*, the basal portion of which is thick, opaque, and coriaceous; and the terminal part thin and membranous; the transition between the two kinds of membrane not being gradual, but sudden. The wings covered by these limbs are membranous, and of the size of the hemelytra. On examining an hemelytron, the three areas of which wings and tegmina are composed are here distinct; but they do not extend beyond the corium (or basal coriaceous part); hence the apical membrane seems a piece added to the ordinary structure; sometimes being, in fact, absent, although the corium is distinct. In some instances, the entire hemelytra are formed of membrane, or rather the substance of the corium is so much diminished that it resembles the apical membrane. When at rest, the apical membrane of one hemelytron folds upon that of the other, and the position is usually horizontal. As to their neuration, the basal corium, as may be conceived from its similarity to the substance of the elytra, is generally almost destitute of nerves; but the apical membrane differs in having more or less numerous nerves, which serve for the distinctions of genera and sub-genera.

d. *Elytra* (see fig. 133).—This is the name given to the hard scaly or horny wing covers, or anterior wings of beetles; they are thickened opaque plates, generally carried, when the insect is not on the wing, in a horizontal position upon the back, with the internal (or anal) margin (or suture, as it is technically termed) straight, and in the direction of the middle line of the body. They are destitute of nerves, and are internally lined with a thin membrane. As to their consistence, they are variable, although generally very hard and horny; sometimes even so firm as to be with difficulty pierced by a pin. In other instances, however, they are flexible, or elastic, yielding to pressure; and in others, even soft, varying according to the variations in the consistence of the body. As to their form, they are generally in the figure of an oblong square, having the posterior angles more or less rounded; at other times they are more triangular, oval, or even almost semi-hemispheric. Sometimes they entirely cover the abdomen, at others they leave the extremity of this part exposed; and sometimes, as in the *Brachelytra*, they are very short. As to their surface, they are flat, convex, gibbose. They are also variable as regards their clothing; some being quite naked, others hairy, woolly, silky, spiny, squamose, and rugose, like shagreen, or with impressed or elevated spots, either placed irregularly (fig. 133, o), or disposed in lines (*Lineato-punctate*, fig. 133, x), or with impressed lines (*Elytra striata*, fig. 133, †). Their colours are very variable, according to the habitation of the insect. Thus beetles, living in dark places, underground, and stones, &c., are generally black, whilst those which are exposed to the light are more variegated in their tints. As already observed, these organs, during flight, are but little serviceable as locomotive instruments; and unless it were for the manner in which they are carried at such times, it must be evident that, from their size and substance, they would necessarily present a great obstacle against quick motion in the air; but this is provided against by their being carried either in a horizontal direction, where they are extended laterally, or in a vertical position, where they do not extend laterally (as in the burying beetles, *Necrophagus*). Ordinarily, as their name imports, they cover the wings; but in some beetles the wings are not thus defended, owing to the small or irregular form of the wing-covers. In the *Brachelytra*, however, in which the elytra are of the least size, and the wings large, they possess their ordinary function, the wings being very much folded. In some beetles the wings are entirely wanting; and here the elytra are firmly soldered together, thus becoming a defence for the abdomen, the upper surface of which is, in such cases, soft and membranous.

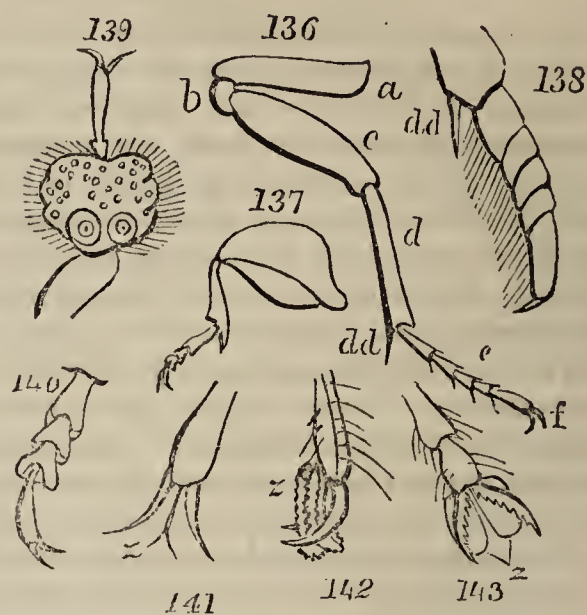
e. *Halteres* (see fig. 126 and 127, z. z).—These organs, which are usually termed balancers or poisers, are a pair of short threads arising behind the base of each of the wings in the *Diptera* (to which order they are exclusively confined), and terminated by a small oval or triangular knob. These organs are capable of a very rapid motion; and it has been usually supposed that by their beating upon the winglets (alulæ), they produce the humming noise so distinctly heard in this group of insects during flight. That they do thus beat upon the winglets, we have already observed; but it appears doubtful whether this action be the cause of the sound in question, because those *Diptera* which do not, either by nature or artificially,

possess winglets, make a buzzing noise. The same is also the case with the bees and other *Hymenoptera*. Other naturalists have supposed the noise to originate in the motion of the wings themselves, or (with more probability) in the rushing of the air through a spiracle near the base of the halteres; in which case, the sole use of the halteres will be as poisers to keep the body steady in flight. Thus Schelver cut off the halteres from a fly, and found that it could no longer fly; hence (and from other circumstances) he considered that the halteres are connected with respiration. For this reason, apparently, Kirby and Spence have regarded these organs as not being the analogues of the lower pair of wings, but as organs, *per se*, an opinion likewise maintained by Latreille (Cours. d'Entomol. 241. *). Their insertion upon the metathorax, in a position with reference to the metathoracic spiracle analogous to that of the lower wings of *Hymenoptera*, together with their occurrence, in an order where only two mesothoracic wings are developed, are reasons amply sufficient to induce us (regard being especially had to the law of relative and proportionate development already alluded to, in speaking of the variation in the size of the thoracic segments) to consider the halteres as analogous to the second pair of wings, and not as anomalous appendages.

f. *Pseudhalteres* (præhalteres, Latreille).—We have applied this name to a pair of organs somewhat similar in their construction to the halteres, but placed in front of the wings, in the order *Strepsiptera*, a name signifying twisted wings, and proposed by Mr. Kirby for the extraordinary group of bee and wasp parasites; in allusion to this pair of narrow, elongated, curved, and channelled processes, which (notwithstanding the observation of Mr. F. Bauer, that they were connected with the fore-legs,) he regarded as analogous to elytra. Subsequent authors, however, doubted this analogy, and Latreille changed the name of the order to *Rhipiptera*. More recent observations have, however, demonstrated that these organs are attached to the mesothorax, which, as well as the prothorax, are extremely short; and that the large pair of fan-shaped wings are representatives of the lower wings of the *Orthoptera*, which are folded longitudinally in a similar manner, although the structure of the thorax is very different. Latreille, however, regards these organs as analogous to the mesothoracic tegulæ, or basal wing-covers, of the *Lepidoptera*. He likewise considers them as somewhat analogous to the lateral prolongation of the prothorax, observed in some species of *Psychodæ* and *Scenopinus* (*Dipterous* genera). As already observed, however, they have been demonstrated to be the only mesothoracic appendages found to exist in these insects (the wings being metathoracic), consequently they must be regarded as analogous of the mesothoracic organs of flight. During the short time that these insects pass in the winged state, the pseudhalteres are observed to quiver very intensely.

2. *Legs, or the organs of terrestrial or aquatic progression*.—If we have found the organs of flight constructed in a manner totally unlike those of birds, we shall discover equally great differences in the construction of their legs. Thus, whilst the former are provided with but a pair of organs for progression on

the land, winged insects have three pairs, spiders four pairs, crabs five pairs, and centipedes and millipedes



more than a hundred legs. These organs arise from the sternum of the various segments of the thorax in the true insects, and are employed not only in walking, running, creeping, and climbing, but also in leaping and swimming, as well as in various operations connected with their economy. They consist of a series of tubular joints, formed of a similar substance with the remainder of the external parts of the body, and are provided with internal muscles and nerves. The joints have received a series of names analogous to those of the legs of the higher animals. They are the coxa, trochanter, femur, tibia, and tarsus. The coxa (136, a) is the basal joint articulating with the sternum, and very variable in form. The trochanter (136, b) is a very small piece connecting the preceding with the thigh or femur (136, c), which in general is the thickest part of the leg, and in leaping insects greatly thickened, and sometimes toothed beneath. The next piece is the shank or tibia (136, d), a piece generally somewhat shorter and more slender than the femur, and often gradually thickened towards the tip, where it is armed with one or two spurs or spines (calcaria, 136, 138, dd), varying in their number and size in adjacent groups. The terminal part of the leg is termed the tarsus (136, e), divided into several joints, never exceeding five in number, which is always found in the majority of insects with membranous wings, undefended by wing-cases. In many beetles the number is variable, as stated in our article COLEOPTERA, and the same is the case in the *Neuroptera*, &c. The under surface of these tarsal joints is generally clothed with short hair or down, often forming a kind of cushion or brush; sometimes, also, the underside exhibits several small circular membranous plates or soles (fig. 139, fore tarsus of a *Dyticus*). The penultimate joint is also often divided into two lobes, and the terminal joint is also generally terminated by two small bent hooks (ungues, 136, f), between which, in many insects, there are one, two, or three small, often membranaceous, appendages, termed pulvilli (fig. 141, 142, 143, zzz). In some tetramerous coleopterous insects the penultimate joint is very minute (fig. 140). Messrs. Kirby and Spence regard the fore-legs of insects as arms rather than legs, and accordingly term the anterior tarsus the hand, calling the basal joint the planta or palm. That the fore-legs are highly important in performing the economy of the insect cannot be doubted; they are also often of a very different

* Latreille consequently also regards the winglets as the true analogues of the lower wings, although he admits that "ils me semblent néanmoins partir d'un point un peu plus élevé que les ailes."

form in the individuals of different sexes of the same species. They are often formed for seizing the prey of the insect, and are then called raptorial (*pedes raptorii*), the thigh being thickened and spined, and the tibia closing upon it. The hind legs are also often peculiarly organised, as in the bees, where they are polliniferous (*pedes polliniferi*), or in the grasshoppers, &c., where the femora are greatly thickened, and used in leaping (*pedes saltatorii*, fig. 137)*. In some other insects they are terminated by a broad, flattened, and strong ciliated tarsus, admirably formed for swimming, as in the water-beetles (*pedes natatorii*, fig. 138). The tibia in the anterior legs are often dilated and notched on the outer edge, as in the mole-cricket. These legs thus become proper for burrowing (*pedes fossorii*. See our article ENTOMOLOGY for figures of these variations of legs). In some lepidopterous insects, especially amongst the butterflies belonging to the family *Nymphalidæ*, the fore-legs are very short and rudimental, the tarsi being almost obliterated, and quite unfitted for walking. In some insects the various parts of the leg fold upon each other when unemployed, and are there received into certain channels prepared for their reception on the under side of the thorax. This is the case with the pill-beetles (*Byrrhidæ*), mimic-beetles (*Histeridæ*), &c. As regards the relative proportions of the legs of insects, the general rule is, that the anterior are the shortest, and the posterior the longest; and as regards their length, the shorter and more robust the body, the shorter are the legs, and *vice versâ*. In running insects, also, the legs are longer than in those which crawl. Generally, the legs do not much exceed the body in length, but occasionally they are much longer. As regards their direction, the anterior legs are generally directed forwards, and the four posterior backwards. It would occupy far too much space were we to enter into a detailed notice of all the variations in form which occur in the legs of insects.

C *The abdomen, or the seat of the organs of generation.*—We have now arrived at the third and last principal division of the body which encloses the greater portion of the intestines, the organs of generation, and their appendages. Unlike the preceding part of the body, the abdomen, from being destitute of locomotive organs, necessarily exhibits a much less complicated organisation in the various segments of which it is composed than those of the thorax, and typically consists of nine segments, exclusive of the anal apparatus, each being composed of two arcs, or half segments, one upper and the other under. These rings are attached together by membrane, and either meet at the edges, or slide into each other like the tubes of a telescope. The dorsal one is termed the back (*dorsum*), and the ventral one the belly (*venter*). We have already seen that, in the larva state, several segments exist which are not found in the imago; and the examination of the abdomen in various insects clearly proves that these last segments are abdominal ones. Thus, if a male ear-wig be examined, it will be perceived that there are nine distinct abdominal segments, exclusive of the anal forceps; but in the female, it will be perceived, that although, with great care, the nine segments be discoverable, two of the terminal ones have assumed a rudimental appearance.

The abdomen of some beetles exhibits a curious character in this respect. Thus, in *Carabus*, if the under surface of the abdomen be only examined, it would appear that there are but five abdominal segments; but, if the back of this part be viewed, nine joints will be discovered; another peculiarity exists in the stinging *Hymenoptera*, in which the males have seven, and the females only six abdominal segments. The union of the abdomen with the thorax is effected in two different modes in different groups. Thus, in all insects which have the wings defended by wing-covers *hemelytra*, *octegina*, (beetles, bugs, tree-hoppers, &c.), as well as in many insects with entirely membranous wings, the base of the abdomen is as large as the extremity of the metathorax, and is united to it by membrane throughout its entire breadth or circumference, in which case the abdomen is said to be sessile. In the hymenopterous order, the saw-flies and *Siricidæ* are distinguished by this character from the other tribes. In the other mode, the abdomen is connected with the thorax only by a slender portion of its base, and this is the case with those insects to which we have alluded in our account of the curious apparatus for elevating the abdomen, in our account of the metathorax. Insects thus distinguished are divisible into two sections; first, those in which the union is effected by a very short piece, and the abdomen is as broad as the posterior part of the thorax, so that, as in the hairy-bodied bees, it appears to be affixed by its entire breadth; and, second, those in which the connecting piece is elongated into a peduncle, and the base of the abdomen itself narrow. This is the case with many exotic wasps, sand wasps (*Ammophila*), &c. In the latter division the abdomen is said to be pedunculated or petiolated. The peduncle itself is liable to great variation. Thus, in some ants, it consists of two knots (*petilus binodosus*); in others only of one. Sometimes it is disproportionately long; at other times it is saucer-shaped, bell-shaped, &c. Of the shape of the entire abdomen little in general can be said. It is, however, more generally triangular, ovate, or quadrate, with the posterior angles rounded off; generally, too, the upper surface is more or less depressed; sometimes it is very short, at others disproportionately long; sometimes wider than the thorax, but more commonly narrowed. The extremity of the abdomen is generally pierced by the anal aperture. The terminal segment is very variable in its form, being formed with reference to the coupling of the insects, or to facilitate the disposition of the eggs in appropriate situations. Sometimes, also, it is organised in a manner to become an instrument of defence or offence. The various organs to be noticed below form part of this segment. It still remains for us to notice the motions of this part of the body. Unlike the thoracic segments, which, from bearing the organs of locomotion, are necessarily required to be as firm as possible, and are not, consequently, capable of much distinct motion, the abdominal segments being destitute of such organs, and having important functions to perform, are, on the contrary, gifted with a considerable but variable degree of motion. Thus, in those species which have the extremity of this part of the body furnished with offensive or defensive instruments, it is capable of very considerable movements in every direction. This is the more noticeable in insects which have a very much elongated abdomen; as, for instance, the ear-wig,

* We must refer to the article CERCOPIDÆ, where we have entered into various details relative to this subject.

the *Staphylinidæ*, &c. Insects which, on the contrary, have the abdomen short, and especially those in which it is defended by the wing-covers, possess but very little power of motion in this part of the body. Another circumstance, also, has much influence in the same respect; when the segments of the abdomen simply touch each other at the margins, the motion is very limited; but in those which have the abdominal wings formed to slide into each other, the motion is much more extensive.

The organs of generation (with the exception of those of the male, *Libellulæ*, which are placed beneath the first abdominal segment), are situated at the extremity of the abdomen.

The sting (*aculeus*), and the ovipositor (*oviductus*), are the only instruments connected with these organs which it will be convenient to notice in a work like the present, and these have already been described in our articles, *Hymenoptera*, *Cicada*, &c. Besides these, the extremity of the abdomen is sometimes furnished with additional appendages, such as the forceps of the earwig, common to both sexes (but considerably larger in male than the female), and of the scorpion-fly (*Panorpa*), in which it is only found in the male: the long and slender threads of the may-flies (*Ephemera*), which seem to be of service to these insects in their alternate rising and falling flight, being brought into contact when ascending, but expanded during the descent; other shorter and broader appendages are found in the dragon-flies, cockroaches, spectre-insects, &c., sometimes these appendages are articulated, at others simple and entire.

We have now brought our review of the external organisation of insects to a close. That it has extended to a considerable length we are aware, and that it must be to a certain extent comparatively uninteresting to many readers we much fear; but it appeared impossible to dismiss the subject at shorter length, consistent with the increased number of organs exhibited to us by insects, and which so far exceed those of the higher animals. We have endeavoured as far as possible to keep clear of those minute details which may be said to have reference to a specific instead of a general sketch of entomology. We have, therefore, in the next place, to direct our attention to

Sub-section 2.—The internal anatomy of insects.

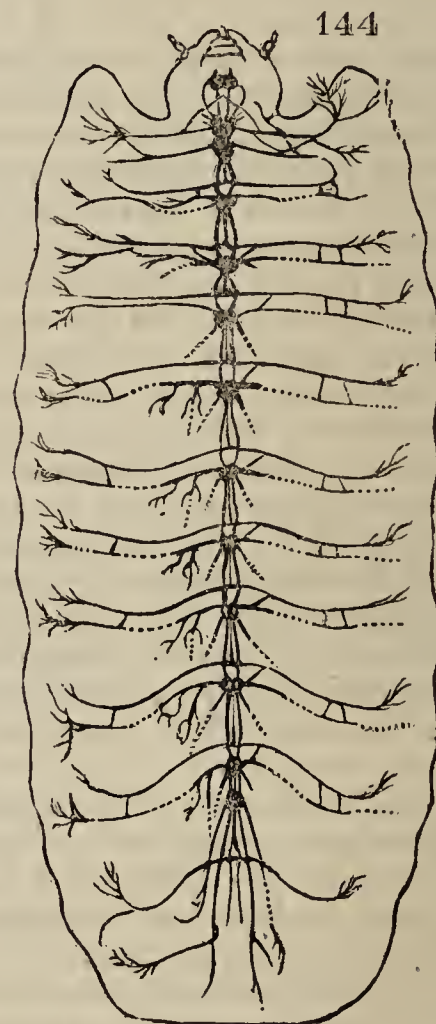
Having already stated that the skeleton (upon the variations of which much importance is placed in the higher animals), is in insects external, we at once perceive that our labours on arriving at the internal anatomy of the latter have considerably diminished.

This, indeed, is one of the chief charms of this branch of zoology; for whilst in the other invertebrated animals it is almost impossible to preserve the individuals, except in spirits; and in the vertebrata, except by stuffing the skin, whereby the form of the body is entirely dependent upon the fancy of the person who “puts up” the specimen; insects in almost every instance preserve their form and colour with a freshness often quite equal to the life. It remains for us, therefore, to notice (which we shall do in the most concise manner); the internal systems of sensation, digestion, circulation, respiration, and motion. The generative system, for obvious reasons, will be left untouched by us.

A *The sensitive or nervous system*.—The chief means whereby the intercourse of animals with the external world, by the instrumentality of the senses,

is maintained, is the nervous system, originating in the brain or the spinal cord.

Hitherto this branch of our subject, and indeed the internal structure of insects in general, has received too little attention from entomologists, of whom we are compelled to say, that mere external form and the collecting of specimens occupy their chief attention. Swammerdam was the first author who carefully traced the nerves of several insects, as the bee, the silkworm, and the *Oryctes nasicornis*; but Lyonnet was far more elaborate in performing the same operation in the caterpillar of the goat-moth. More recently Strauss-Durckheim, L. Dufour, and Burmeister, and especially, with reference to its gradational modification at various periods, M. Herold in the white butterfly, and our own countryman, Newport, in the *Privet Sphinx*, have laboured assiduously in the same field.



Nervous system of the Caterpillar of the *Cossus ligniperda*. The dotted lines indicate the situation of the nerves concealed by the incumbent muscles.

In insects, as in the other articulated animals, this system is quite unlike that of the higher animals, and consists of two medullary cords or threads, exhibiting a series of knots or ganglia, whereby they are united together at certain distances, occupying the lower surface of the internal part of the body, and being defended from the action of the thoracic sternums by the internal Y-like processes above described, as the pro-, meso-, and metathoracic furcæ. Sometimes the two ganglia of each segment are more or less distinct, and sometimes they are united together side by side, occupying the medial line of the body; and the same occasionally occurs with the communicating threads themselves. The nervous ganglia or knots are placed at more or less equal distances from each other throughout the entire length of the insect, sometimes, indeed, so close, that they constitute but two or more ganglia.

This is the case in the perfect state of the hemipterous insect, *Ranatra linearis*, for a figure of which the writer is personally indebted to John Anderson,



Nervous system of *Ranatra linearis*.

Esq., of Richmond, by whom a most elaborate series of preparations of the nervous system throughout the entire range of the animal kingdom has been made, in illustration of a very valuable paper read on the 23rd of April last before the Physical Section at Guy's Hospital, with reference to the remarkable analogies (noticed in the early part of this article), exhibited by the human embryo in the various stages of its passage to perfection, with the perfect state of the inferior animals. We trust that this admirable memoir will be shortly published.

In the larva there are thirteen knots, corresponding with the number of rings of the body; but these organs, like the other internal systems, are modified during the passage to the perfect state. Thus Dr. Herold in his celebrated work upon the Internal Anatomy of the white Garden Butterfly, ascertained as the larva approached maturity, the second ganglion became united with the first; the fifth and sixth approach and unite; then the third and fourth; whilst in the pupa, the seventh and eighth have entirely disappeared; so that, instead of thirteen, the imago possesses but eight ganglia.

On examining the invertebrated, or rather the externally vertebrated structure of an insect with that of the internally vertebrated animals, we find no part corresponding with the brain; or rather the organ which might be regarded as analogous thereto, and which, indeed, has been called the brain, namely, the ganglia of the head, are repeatedly represented along the entire length of the body; consequently it has been supposed that the nervous cord of the insect represents the great sympathetic nerve of the latter; although, perhaps, it would be more correct to regard it rather as the spinal cord.

The matter of which the nerves are composed is a soft pulpy substance, enclosed in a simple and transparent membrane.

The first pair of ganglia is always situated in the head of insects above the digestive canal, and is furnished with nerves extending to the eyes, antennæ, mandibles, maxillæ, and labrum. The other ganglia

are lodged in the thorax and abdomen, or in the former alone, and similarly placed above the alimentary canal; the two thick nervous filaments connecting the head ganglia with the prothoracic ganglia are deflexed, so as to surround the oesophagus, forming a kind of nervous collar. From the thoracic and abdominal ganglia are emitted nerves which communicate with the legs, wings, and other organs of the body. In the larva of the goat-moth, Lyonnet counted forty-five pairs of these nerves, besides two single ones, thus making a total of ninety-two, which is considerably more than are found in the human body; namely, seventy-eight.

In the vertebrated animals the nerves proceed from the brain, which is enclosed in the head; in insects, on the contrary, we have seen that nerves proceed from the various knots, whether belonging to the head, thorax, or abdomen; hence we might analogically call the various ganglia and their connecting filaments an elongated brain. In the vertebrated animals sensation originates in the brain; and hence, from the concentration of this organ into one mass (for so we may call it although divided into two lobes), sensation is more concentrated, and the feelings rendered highly acute. In insects, on the contrary, owing to the want of concentration of the nervous ganglia, sensation is necessarily much less acute; and, as the nerves laterally emitted by one ganglion generally serve for the segment of which it forms a part, the connexion with the preceding or subsequent ganglia being at the same time slight in proportion to the slowness of the connecting filaments, we are enabled satisfactorily to account for the apparent want of sensation in insects, as exhibited, for instance, in the cockchaffer, which will walk about, although some bird has nearly emptied the body of its viscera; or by the head or abdomen of a wasp, which will continue to bite and sting long after they have been separated from the rest of the body; or by the headless trunk of a male mantis, which has been known to unite itself to the other sex, as recorded by Dr. Smith, and quoted by Kirby and Spence. Another instance is recorded by the Rev. Mr. Bird, in a memoir published in the Entomological Magazine, entitled, "On the want of Analogy between the Sensations of Insects and our own."—"When I was young in entomology," observes this kindly-hearted writer, "I wished anxiously to find the quickest mode of killing an insect. Having captured a pretty beetle, *Malachius æneus*, it struck me that by cutting it in two at the junction of the thorax and abdomen, the part which gives rise to the name insect, *Insectum*, *Εντομον*, I should kill it in a moment. I took a pair of scissors and divided it; the parts fell on a piece of white paper which lay before me. Far from being dead in an instant, I was grieved and surprised to see the head with the two fore-legs attached to it begin to run about the paper. It occasionally stumbled, but rose again, and exhibited, if I may so speak, perfect self-possession. It made for the edge of the paper; but arriving there and looking over it, seemed to think it too precipitous, and so coasted along in quest of an easier descent, which, nevertheless, it did not seem able to find. This coasting and searching for a convenient place of descent, suited to its curtailed condition with respect to legs, of which it appeared perfectly aware, occupied the head incessantly. I regarded it with astonishment—'Here, then,' I said to myself as I watched

its motions, 'here lies the vitality of an insect; the body at any rate is dead;' but in this I was quickly undeceived, for in about a minute after the body had fallen upon the paper, I saw the hind legs brought upward, and employed in deliberately brushing and cleaning the wing-cases, exactly as a house-fly may be seen to clean its wings on a window pane. The legs were then withdrawn, the cases raised up, and true wings expanded from beneath, and all made ready for flight, which, indeed, I expected to see; but the body seeming then to become aware that there was no guide, the head, its former companion, being in possession of the eyes, the design was abandoned, the wings folded up in their usual beautiful manner, and the attitude of rest again assumed. This whole process was repeated with perfect regularity at intervals of about a minute, if I rightly remember*. A more perfect act of a sentient creature could not be exhibited: the head continued to run about, and the body to clean and expand its wings, the one for about twelve and the other for sixteen hours, their energies gradually decaying, till they appeared to perish, or rather to sleep. And now, I ask, which was the beetle? where was the original creature? had not the head and the body an equal right to be taken as its representative? Is not all analogy between insects and ourselves destroyed by such a phenomenon?" And in the same view of the subject it has been considered better to consider each nervous ganglion as a separate and independent centre of volition. But surely we have no authority for adopting such a view, the ganglia being united together, and the insect constantly dying when thus divided, instead of each portion forming itself into a new being, like the planaria and some other invertebrated animals.

The nerves, as before observed, form the medium whereby the notice of the various transactions of the external world is conveyed to the seat of the instinctive or intellectual organs. The perceptions thus obtained constitute the senses, of which *sight*, *hearing*, *smell*, *taste*, and *touch*, are those which are generally allowed to prevail. Some physiologists (Dr. Virey, &c.), add to these *love*, and the internal sense of *thought* or *instinct*.

The former of these, as a perception distinct from the mere physical act of propagation, can scarcely be allowed to insects. In this point of view the subject cannot be discussed in a work like the present. The instinctive powers of insects also appear to the writer of this article to be on a very different footing compared with the other senses. We shall therefore defer our observations thereon to the subsequent section of this article.

That insects possess several of the senses is certain; but the seat of these senses is not ascertained; nei-

ther can we by any possibility arrive at a certain conclusion that the senses of these animals are identical with our own. Their entire organisation having been shown to be so totally different from that of the vertebrated animals; indeed, as Mr. Mac Leay has observed in the *Horæ Entomologicæ*, there is no reason why animals constituted upon a plan so totally unlike our own, should not possess senses of which we have no idea. We will, however, adopt the general opinion, and speak of the senses of insects as analogous to our own, the consideration of which will form so many distinct sub-sections.

a. *The Sense of Sight*.—The eyes of insects are the only organs which we can with any certainty refer to the sense of which they are the seat. We have already described the external structure of the eyes, and ocelli or eyelets, and shall therefore now notice their internal organisation, and the mode in which vision is effected. On making a perpendicular incision into the eye, it is found to consist of various layers; the external membrane is hard, transparent, and composed of a multitude of hexagonal facets, each forming a more or less distinct conical cylinder, running towards the centre of the eye; beneath this external membrane is a layer of coloured matter, often of a blackish violet hue, but sometimes green, red, or banded, pierced with as many holes as there are facets or pupils; beneath this is a varnish of a black colour, within which is another belt, the inclosed space receiving the optic nerve, with its numberless ramifications, a branch probably going to each facet. The structure and functions of the eyes of insects have been investigated with great accuracy by Müller, who has proved that the refractive powers of the ocelli must be very great, each ray of light suffering a four-fold refraction; the first produced by the convex cornea, the second by the anterior convex surface of the lens, the third by the posterior convex surface of the lens, and the fourth by the convex surface of the glassy body itself; hence a very distinct short sight, suitable for small objects, is possessed by these eyes. In the compound eyes the effect is different, here, owing to the convexity of these eyes, and the consequent obliquity of the lateral facets and their cylinders, a much wider horizon must be embraced, each individual facet surveying but a small space of the entire field of vision, each thus contributing to the perception of objects comprised within the view, those rays of light only that fall in a right line upon a facet, *which itself forms the segment of a circle*, can reach the optic nerve of this facet, whereas all others are withheld by the pigment which separates the individual glass cases from each other, and partly circularly surrounds the margin of the crystalline lens beneath the cornea. According to Müller, each nervous filament conveys to the bulb of the optic nerve the impression of the ray which it has individually received; and as all the nervous filaments at first separated by the pigment are at length united together into one common and continuous bulb or nervous expansion, the impression received by each filament is united to those of the others in the bulb of the optic nerve, and so a common and continuous image is produced. This author, however, further considers, that rays coming from one point of a remote object *will illuminate throughout more than a single cone*, and thus to each luminous point without there will correspond in the interior of the eye, *not exactly a single illuminated point*, but rather a little circle of diffused or

* This fact apparently controverts the conclusion of Burmeister, that after the separation of the nervous cord at any part, the voluntary motion of the organs seated beyond the point of incision is lost, but that the irritability of the muscles, that is to say, their power of reaction upon external excitement, is retained by these organs as long as life remains. We say apparently, because when the increased size of the muscular system of the wings in malachius (which is a strong flier), is considered (just as in the swimming motion of the hind legs in a dytiscus deprived of its anterior ganglia, recorded by Burmeister and in which the muscles of the hind legs are very greatly developed), the unfolding and folding of the wings may be explained, without reference to instinct supposed to be possessed by this remnant of the body.

dispersed light, and in consequence an image of but little distinctness will be reproduced on the internal surface or retina, the distinctness of the image increasing in proportion as the object approaches the eye. It is, however, admitted, that the distinctness of the image will increase in proportion to the number of facets, and the length of the cones, for the longer the cones are, the more completely will all rays entering them obliquely be prevented from reaching their internal extremity or apex. Upon these remarks we would, however, be permitted to observe, that, from the fact of each facet being the segment of a circle, as well as from the exceedingly minute size of the pupil-like aperture of the pigmental division of each facet, those rays only which fall upon the centre of each facet, and pass down the axis of each cylinder, can reach the nervous filaments in the centre of the eye, and thus there can be no such dispersion of the rays and consequent indistinctness of vision above noticed. We submit this opinion with great deference, and because it appears to us, that in the various experiments made upon this subject, due allowance has not been made for the external circularity of each facet of the cornea.

Immediately in connexion with the sense of sight ought to be noticed that remarkable property which many insects possess of emitting a peculiar light, and which, as we apprehend, should be regarded as displayed by insects with a view to its perception by the eyes of their associates, just as the chirping of a cricket is adduced in favour of the hearing of its fellows. Amongst insects, the *Lampyridæ* (or GLOW-WORMS, which see) and the *Elateridæ* are the only families which are decidedly proved to possess this faculty; although it has been asserted to prevail in the *Fulgoridæ*, and some isolated species of other groups, but there is no distinct evidence of its existence in these latter insect. We must, however, refer to the various articles upon these families, where we have dwelt more at large upon the nature and peculiarities of these luminous exhibitions.

b. *The Sense of Hearing.*—Linnæus describes insects in general as "*Muta nisi alio proprio instrumento, sonora; Surda stridorem ætheris licet percipiant.*" From many facts, however, it is evident that insects distinguish sounds in some manner or other, although the greatest uncertainty prevails amongst naturalists as to the organ of this sense. Without presuming to offer any opinion of our own upon a point on which so many learned physiologists are at variance, we shall content ourselves with noticing the production of sounds caused by insects, which has invariably been employed as an argument in favour of the possession of the sense of hearing by these animals, and then allude to the opinions which have been entertained as to its seat.

Unlike the higher animals, insects possess no distinct vocal apparatus terminating in the mouth. The noises made by insects may be divided into three kinds, according to the mode in which they are produced. In the first, the sound is produced by the mere friction of one part of the external integument against another, whereby, when an insect is disturbed, it forcibly rubs one portion of its body against another in its endeavours to escape. In this manner, by the friction of the prothorax against the base of the mesothorax, or the abdomen against the elytra in beetles, a continuous and rather loud sound is produced. The second kind of sound is produced by numerous

flying insects, and which our bard of the Seasons has alluded to in his lines,

Yet not unpleasant is the ceaseless hum
To him who wanders in the woods at noon.

The mode in which this sound is produced has been endeavoured to be explained in a variety of ways. We have already alluded to these opinions in our account of the *Halteres*, and shall only add, that the experiments of Burmeister and others, together with the fact that bees produce as loud a sound as dipterous insects, although unprovided, like the latter, with winglets or halteres, seem satisfactorily to prove that it is owing to the rushing of the air through the thoracic spiracles that the buzzing is produced. The third kind of sound is produced by a distinct modification of certain organs for their express emission. We have already described these structures in the Linnæan genera *Gryllus* and *Cicada*, which comprise the only insects thus circumstanced, and which are confined to the males. The death's-head moth also produces a plaintive kind of cry, as described in our article upon that insect.

In many works we find the effects of other sounds upon insects described, an instance of which we have already recorded in our account of the great green grasshopper.

As to the organs supposed to be the means whereby this sense is produced, we find that the opinions of the majority of authors may be divided into those by which the seat of this sense is asserted to be wholly unknown, and those who consider that the antennæ in some way or other perform the functions of organs of hearing. Other opinions have, indeed, been maintained by several other and distinguished authors. Thus Treviranus described a small drum-like membrane* on the forehead in front of the base of each antennæ in moths, to which nerves extend, but no analogous organ has ever been discovered in other tribes of insects. Müller in like manner regarded part of the chirping apparatus of the grasshopper as an organ of sound; whilst Rudolphi considered the anterior salivary glands of bees as similar organs. Of continental authors who have regarded the antennæ as analogous to ears, the most celebrated are Sulzer, Scarpa, Schneider, Berkhausen, Reaumur, Bonnsdorf, Carus, Strauss-Dürkheim, Oken, and Burmeister. Kirby and Spence adopt the same view to a certain extent, considering it probable that the primary function of the antennæ may be something related to hearing; they further conceive that antennæ, by a peculiar structure, may collect notices from the atmosphere, receive pulses or vibrations, and communicate them to the sensorium, which, though not precisely to be called hearing, may answer the same purpose. It is true that the antennæ have, by other authors, been regarded as the organs of smell and of touch, the grounds for which we shall notice in our observations upon that sense. Moreover in the higher crustacea (crabs, &c.), the organs of hearing distinctly exist in the shape of oval apertures, inclosing moveable plates, and placed at the base of the larger pairs of antennæ, a circumstance which has been considered as affording a strong analogy in favour of the opinion that the antennæ are organs of hearing.

c. *The Sense of Smell.*—That insects possess, in a high degree, this sense, is evident to every one who

* Did not Treviranus here mistake the ocelli for the ears?

knows with what pertinacity the blow-fly discovers meat, even when concealed under napkins, in safes, &c. That butterflies will fly down to flowers from a considerable height, may be accounted for by the action of their eyes, indeed we have seen butterflies fluttering on the outside of windows, within which were coloured bits of paper, which they evidently mistook for flowers. In the two preceding senses we have seen that their existence might be presumed from the existence of luminous properties in certain species, or by the emission of sounds by others. In like manner the discharge of numerous and varied scents by many insects, induces us to admit the sense of scent in insects, although the organ of this sense is as little ascertained as that of hearing. Thus the disgusting odour of the bug, the cock-roach, or the lady-bird; the rose-like scent of the cicindela; the musk-like scent of the musk beetle; the garlic scent of many andrenæ; the goat-like scent of the caterpillar of the goat moth; or the strong acid smell of many of the ants, sufficiently prove a keen perception of effluvia in insects. As to the organ of this sense the majority of naturalists, Baster, Lehmann, Cuvier, Dumeril, Audouin, Strauss-Dürckheim, and to an extent Burmeister, from analogy with the vertebrated animals, regard the lining of the spiracles as exercising this function; whilst Christian, Reaumur, Lyonnet, De Blainville, and Latreille, consider the antennæ in this light. Marcel de Serres and Bonnsdorf, as well as Christian, conceive the palpi to be smelling organs. Comparetti described various cavities and cells in the front of the head, which he regarded as performing the office of a nose; but his assertions have never been confirmed. Treviranus considered the entire mucous lining of the mouth as the organ of smell; whilst Kirby and Spence give the name of rhinarium, or nostril piece, to the membrane connecting the skull and the clypeus (which they call the nose), and have described a pair of circular pulpy cushions under the clypeus and rhinarium, covered by a membrane transversely streaked with beautifully fine striæ, as the organs of smell, which they discovered in the burying-beetle (*Necrophagus vespello*) and some others. But these discoveries are not confirmed by other and more elaborate insect anatomists, who have discovered no similar organ, nor do Kirby and Spence indicate how scents can pass through the rhinarium.

d. *The Sense of Taste*.—If we have noticed the flesh-fly, as affording a proof of the existence of scent of insects, the same insect may be again cited to prove that insects are not deficient in the sense of taste; indeed, to suppose that animals, having such a beautifully constructed and complicated oral apparatus as is exhibited by the mouths of insects, which also exhibit such discrimination and fastidiousness in the choice of their food, should be deficient in this sense, seems not to be very philosophical, although such has been asserted by Rudolphi and some other physiologists. That this sense is seated in some part of the mouth or digestive organs is, however, generally admitted. Some authors, however, have supposed it to exist in the palpi, whilst others regard it as seated in the pharynx, or at the commencement of the throat. The tongue, however, is more generally regarded as its real seat, this being a fleshy organ in many insects, and provided with a great abundance of nerves, and furnished with saliva from the mouths of the ducts of the glands lying beneath this organ. It must, however, be admitted, that there are many

insects in which the analogue of the tongue is not developed, or exists merely as a horny seta.

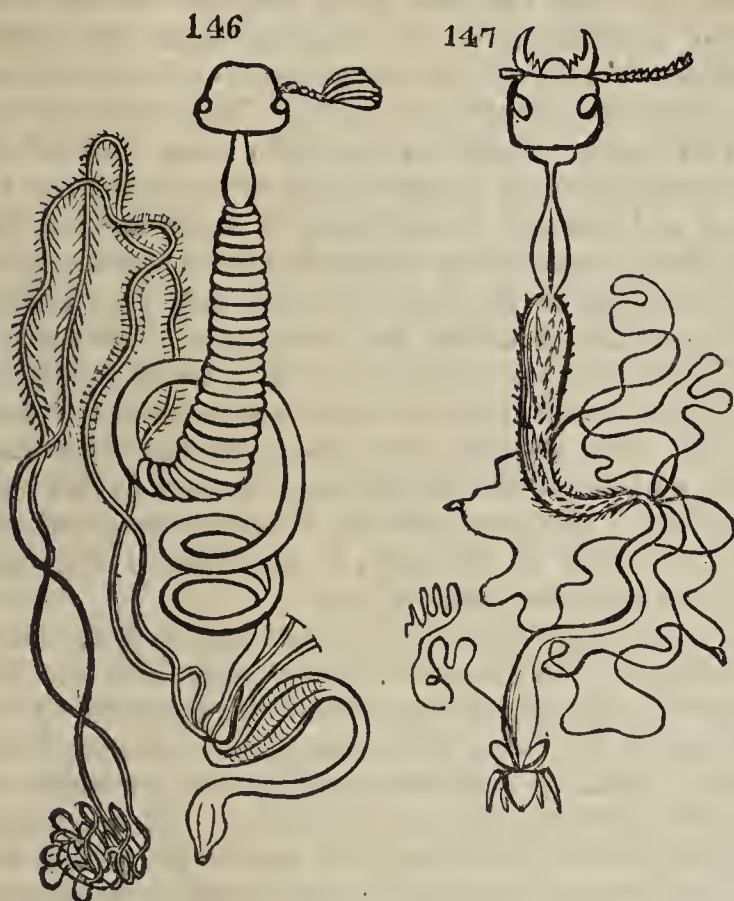
e. *The Sense of Touch*.—In the higher animals the outer envelope of the body is, from its peculiar construction, generally, and in all parts, adapted to receive impressions by this sense; but in insects, the hard scaly texture of the external covering necessarily prevents such a general system of touch, and we are therefore compelled to search for organs which may in an especial manner be regarded as the organs of this sense. Here, too, however, we find difficulties similar to those which have met us in our researches relative to the other senses: thus the antennæ, palpi, wings, and tarsi, and particularly the anterior tarsi, have been regarded as the organs of this sense; and, indeed, the opinion, that the first-named organs constituted the real feelers, has been maintained by some writers with so much zeal, that even violent abuse has been heaped upon persons professing a different view of the subject. It is true, that the antennæ have been generally termed feelers, and the proceedings of some of the *Ichneumonidæ* have been adduced as instances in support of these organs being capable of feeling (as detailed in our article *ICHNEUMONIDÆ*); but here, as Kirby and Spence observe, either by means of its antennæ, it hears a slight noise made by the latent grub, perhaps by the action of its mandibles, or else that, by its motions, it generates a motion in the atmosphere of its habitation, which, striking upon the antennæ of the parasitic ichneumon, are by them communicated to its sensorium. Moreover, the ovipositor of these insects is much longer (in *Fænus* and *Pimpla*) than the antennæ; so that, by inserting the latter into the holes in walls, posts, &c., it is impossible that they can reach the latent grub. Strauss-Dürckheim, and some others, on the contrary, regard the articulated tarsi as the organs of touch; Kirby and Spence considering them also as organs of *active touch*, whilst the same authors, together with Knoch, Lehmann, Cuvier, and Burmeister, regard the palpi as the organs of touch, these parts being, without intermission, applied to every surface, and being terminated by a minute transparent membrane, which is supposed to be the precise seat of this sense; although Strauss-Dürckheim, who carefully examined it, considered it as the organ of a distinct double kind of sense, partaking both of touch and taste. In some bees which we are at present experimenting upon, and which thrive upon moistened white sugar, we notice the maxillary palpi applied to the surface of the sugar all the time that the insect continues to feed.

B. *The Digestive System*.

After the food has been taken into the mouth and been submitted to the action of the trophi, it passes into the pharynx or entrance to the stomach. The digestive organs are opened at each end, extending from the mouth to the anus; sometimes they are straight, and at others bent or twisted together; and, as in the higher animals, they are short in the predaceous species, but elongated in those which feed upon plants: sometimes they are of an equal diameter throughout, but at other times variously constricted. Where the number of these constrictions is the greatest, the digestive tube consists of, 1st, the pharynx; 2nd, the œsophagus or gullet; 3rd, the craw or jabot; 4th, the gizzard or ventriculus; 5th, the stomach or duodenum; and 6th, the intestines,

including the intestinum tenue or small gut, the cæcum or blind gut, and the rectum or vent gut. In addition to this variously divided digestive tube,

it penetrated by imbibition. Strauss-Dürckheim, however, discovered that there exists in the cock-chaffer a series of orifices opening into each side of the dorsal vessel, and furnished with valves.

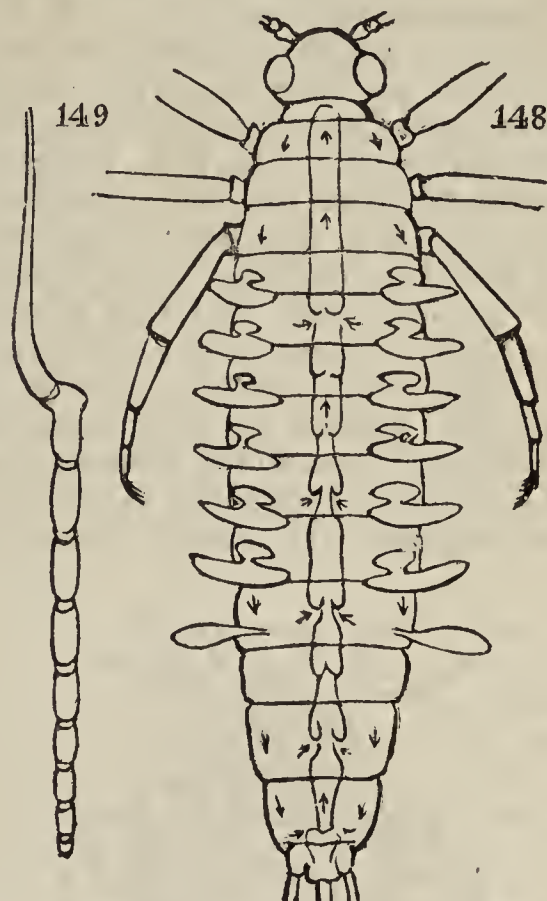


Figs. 146, Digestive system of *Melolontha*; 147, ditto of *Staphylinus* (from L. Dufour).

there are a number of slender membranous tubes filled with a fluid apparently analogous to the bile; they are, for the most part, inserted into the stomach near its outlet, where the secretion, which is thus discharged, acts upon the already partially dissolved food, and converts it into a pulpy mass or chyle, the nutritive parts of which, as it passes into the small gut, are taken up by the inner membrane of the latter, and passed into the cavity of the abdomen, lying upon and around the parts to be nourished by absorption. The indigestible parts of the food are collected in the cæcum, and thence passed out of the body.

C. The Circulatory System.

It has been generally considered that insects were destitute of a real and direct circulation analogous to that of the higher animals; but the recent observations of many distinguished authors (Comparetti, Carus, Bowerbank, Burmeister, &c.), appear to have fully proved that they do possess such a system. Although there is no part in insects strictly analogous to the heart, yet this name has been ordinarily given to a series of large reservoirs forming a longitudinal tube, extending throughout the entire length of the body (commencing at the first thoracic segment) beneath the dorsal integuments and muscles, and which is easily distinguished by its alternate contractions and dilatations, similar to those of the heart in the higher animals, which may be constantly observed in the silk-worm and other naked caterpillars. In this dorsal vessel, as it has been called by some physiologists, the blood is contained, and which, unlike that of the vertebrata, is cold, transparent, and often entirely colourless. It was, however, considered that as no outlet had been discovered, there could be no circulation, and yet it was supposed that the fluid in some way or other made its escape, and was disseminated amongst the various internal organs, which



Figs. 148, Larva of *Ephemera*, showing the central dorsal vessel, some of the valves being opened, the current of the fluid being indicated by arrows (from Mr. Bowerbank); 149, lateral view of the dorsal vessel of *Melolontha*.

The dorsal vessel consists, according to Strauss-Dürckheim, of eight successive chambers in the cock-chaffer. Mr. Bowerbank says "they are about equal in number to the sections of the body" in the larva of an *Ephemera*, separated by converging valves, which allow the blood to be propelled forward towards the head, but prevent its returning. The blood abounds in very minute oat-shaped particles, and is seen circulating in every part of the body, from whence, upon each pulsation and opening of the lateral apertures, it rushes into the dorsal vessel, and is conveyed into the anterior part of the body. When the terminal chamber is filled, the blood which it contains causes the lateral valves to close, and the blood to be propelled into the next chamber, which, at the same time also receives a flow of blood from its own lateral openings. In this manner the blood is forced towards the prothoracic chamber, where it terminates, according to Strauss-Dürckheim, in a single artery without branches, which carries the blood into the head, where it is poured out, and thence flows back into the cavity of the body (in distinct arteries, according to Mr. Bowerbank), to be again taken into the heart, which consists of two membranes, the external one of which is furnished with numerous ramifications of the air-tubes. The various air tubes also which are distributed throughout the body, communicate with the blood as it is discharged from the prothoracic chamber, and thus it receives a supply of oxygen. The number of chambers in an imago appears to be smaller than in a larva; we have also seen that the number of segments in the latter are more numerous than in the former. It would therefore form a very interesting subject of inquiry to ascertain the mode in which, and the period when, this loss takes place. The circulation of the blood

is most distinctly seen in the aquatic larvæ, and in the wings of insects, owing to their transparency.

D. The Respiratory System.

The systems of circulation and respiration are necessarily dependent upon each other. In the higher animals the lungs are the receptacles of the air, and the blood rushes into these organs to be oxygenated. In insects we have, however, seen that the circulatory system extends throughout the body, the great dorsal vessel equally extending from one end of the body to the other; hence it is requisite that the respiratory apparatus should be developed to an equivalent degree, and we accordingly find that respiration in insects is effected by means of two great longitudinal vessels or canals called tracheæ, running along the sides of the body beneath the outer integuments and muscles, and which open to the outer atmosphere by means of short tubes, terminating in breathing pores (spiracles or stigmata). The number of these spiracles



Fig. 150, Respiratory apparatus of *Nepa cinerea*, in which the only pair of spiracles are placed at the sides of the anus, the lateral spiracles being obsolete or rudimental.

is various; those of the larva, in which the body is composed of a more regular and uniform series of segments, being more numerous than the spiracles of the imago. In the former they amount to eighteen, that is, nine pairs; whereas, in the generality of perfect insects, the number is, or appears to be, diminished; moreover, in the latter, the spiracles, owing to the greater development of external covering, are generally more or less concealed. Spiracles are of two kinds, simple or composite. In the former the aperture is a simple orifice guarded only by hairs, which prevent the passage of any foreign substance which might be injurious; but in the composite spiracle the aperture is closed by two horny valves, which move backwards and forwards like a pair of folding doors at each inspiration. The former sort of spiracles are generally found at the sides of the abdomen, where the upper and lower arcs of each segment are united

together. The composite spiracles are, on the contrary, appropriated to the thorax.

The tracheæ, which originate in the spiracles, are connected with the two great longitudinal air tubes above mentioned, which likewise emit an infinite number of ramifications extending to all parts of the body, like the branches of a tree. These tracheæ are of two sorts, tubular or vesicular: the former are tubes composed of three distinct membranes, the external and internal layers being of a cellular texture, and the central being composed of a cartilaginous thread, rolled in a spiral direction, and very elastic. The vesicular tracheæ are destitute of this spiral cartilage, and are small bags of a cellular texture, which, when not distended with air, naturally become flaccid. The tracheæ often communicate with each other, and penetrate all the organs, such as the legs, wings, &c.; they are also distributed throughout the intestinal parts of the body, so that the air circulates freely in the most obscure parts.

We have already noticed in our articles *DYTICIDÆ*, *CULICIDÆ*, *CHIRONOMUS*, *EPHEMERA*, and in the present article, various modifications exhibited by the respiratory apparatus of the insects belonging to these groups, which are chiefly aquatic, and in which we perceive two principal modifications: 1st, A series of large lateral organs which act upon the water, and abstract from it the oxygen; and, 2ndly, a concentration of the respiratory functions, by means of an apparatus placed at the extremity of the body, whereby the insect is enabled to obtain a supply of air by protruding this part of the body above the surface of the water, whilst it still remains with its greater part submerged. M. Audouin has also recently noticed another remarkable modification of the respiratory apparatus in insects, which, although terrestrial, are occasionally covered for a great length of time with water. (See his *Memoir upon Nepus fulvescens* in the *Nouvelles Annales du Muséum*).

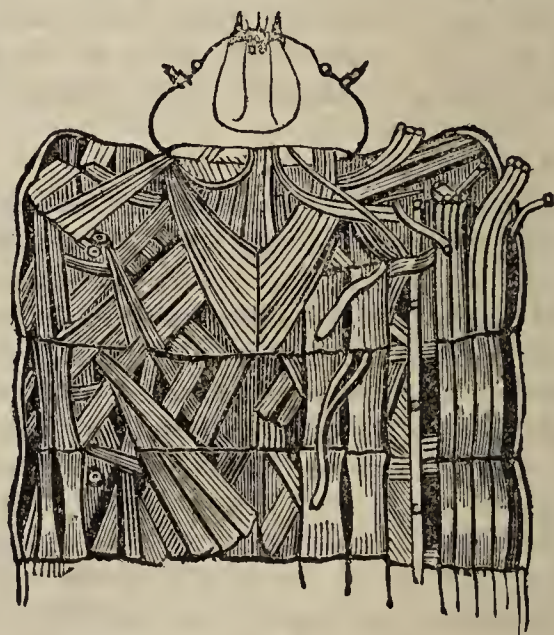


Fig. 151, Dorsal muscles of the anterior segments of the caterpillar of *Cossus*.

E. The Motive, or Muscular System.—The varied structures which we have observed in the preceding parts of this article, upon the external anatomy of insects, are but the visible expression of certain principles which constitute the economy of the various species, and which are regulated in the performance of their various functions by a series of internal muscles, attached to the internal surface of the external covering of the animal. Of the extent of this

system of muscles, some idea may be entertained, when it is stated that Lyonnet discovered 4061 in the caterpillar of the goat moth, 228 being attached to the head, 1647 to the body, and 2186 to the intestines; whereas, in the human body, only 529 have been discovered; so that this insect possesses nearly eight times as many muscles as there are contained in the human frame. This, however, will not appear so extraordinary, when the greater number of legs, &c., in the insect are remembered.

The construction of insect muscles is similar to those of the higher animals, each being formed of muscle and of tendon; the former is fleshy, whilst the latter, which forms the coating and extremities of the muscle, is firm, and not liable to contraction. According to Lyonnet, the muscles are composed of many parallel bands, consisting of bundles of fibres enveloped in separate membranes; these fibres appearing to be twisted in a spiral direction. These muscles are attached at one end to the various processes of internal surface of the outer covering, which serves as their fulcrum, and the other end is attached to the organ to be moved. The size of muscles is proportioned to the movements to be performed by the organs to which they are attached: thus, the muscles of the mandibles are much more robust than those of the maxillæ: in like manner the comparative size of the various organs influence that of the corresponding muscles. Thus, when the anterior wing is enlarged at the expense of the posterior, the mesothoracic muscles are more developed than those of the metathorax; and *vice versa*, in like manner, the muscles of the hind legs of a leaping insect, as a grasshopper, are more extensive than those of the simple walking legs. Muscles, as regards their action, are either flexors or extensors, levators or depressors: by the flexors, which are attached to the inner surface of a limb, it is drawn towards the base, and consequently as it were folded up; extensors, on the contrary, are attached on the exterior part of the cavity of the outer covering of a limb, and acting in an opposite direction, so as to extend the limb. In like manner levator muscles cause the elevation of a limb, whilst depressors bend it downwards. To describe in a more particular manner the muscles of insects, or to trace their varied action in effecting the varied motions which are exhibited by these animals, would occupy a far greater space than we can by possibility devote to the subject in this already too long article.

4thly. *The Physiological and Instinctive Properties of Insects.*

Having brought to a close our review of the general structure of insects, as exhibited not only in their preparatory and perfect states, but also in their external and internal organisation, it would naturally remain for us to lay before the reader the modes of operation by which each of these various structures is rendered serviceable towards the fulfilment of the ends for which the insect has been produced. This would comprise every physiological peculiarity presented to us by the insect world, independent of mere structural modification. But in treating of the internal systems of organs, and, indeed, partially, in our review of the external form of insects, we have thought it might be more agreeable to the majority of our readers to blend together effects with causes; operations with the apparatus whereby they are effected. It still, however, remains for us, as previously observed, to notice the operations of that

power, or principle, which seems totally independent of organisation, and to which the name of instinct is generally applied.

It is necessary for us, however, in the first place, to premise, that it is not our intention to enter into any disquisition upon the nature of instinct. We know, indeed, nothing of the real nature thereof beyond what is exhibited to us by the various phenomena of insect life, and which have been well described as the result of a power "enabling an animal to do that which, in those things that man can do, results from a chain of reasoning; and in things which men cannot do, is not to be explained by any efforts of the intellectual faculties*."

Now these varied phenomena are manifested to us in an endless variety of methods: in the affection of insects for their offspring; in the numerous distinct modes in which the parent insect deposits her eggs in the most appropriate situations; in the construction of nests; in the various stratagems by which insects procure their food; in the modes of defence employed by insects either against their ordinary enemies or accidents; but, more than all, in the varied economy of social insects—bees, humble bees, wasps, ants, white ants. All these varied phenomena appear, however, to be resolvable to two principal heads—the continuance of the species, and the preservation of the individual: indeed, the great end and final care of the endless labours of the social insects can only be traced to one or the other of these causes.

If we confine our attention to the first of these grounds of inquiry, viz. the perpetuation of the species, we find that here, as elsewhere, the great command "Increase and multiply" is obeyed to the fullest extent, as is manifested by the various circumstances connected with the pairing of insects, and especially by the precautions which the parent female exhibits in the careful deposition of her eggs, as already noticed in the early part of this article; whilst the often extraordinary and always interesting peculiarities exhibited by social insects in the construction of their nests, for their own habitations and the rearing of their offspring, the collecting of food, and the feeding of young, have been treated upon in various other articles of this work (ANT, BEE, FORMICIDÆ, HUMBLE BEE, ICHNEUMONIDÆ, &c.).

If, on the other hand, we direct our attention to the preservation of the individual (and many of the peculiarities of social insect life conduct us to this branch of our inquiry), we find the subject also divides itself into two sections, namely, the various stratagems employed for obtaining a supply of food, and the means of active or passive defence adopted by insects. With a few notices of some of the most remarkable of each of these instinctive peculiarities, we shall close the present branch of our subject.

We have seen in the early part of this article that, from the very nature of the functions of the insect tribes, it is essential that the consumption by them of animal and vegetable matter should uninterruptedly be carried on. Hence, as well as from the nature of insects in general, and the great care shown by the female in depositing her eggs in the most fitting situations, there is but little occasion for any exhibition of instinctive reasoning on the part of these animals, with the exception of those which prey upon living

* Lieut. Col. Sykes, in Trans. of Entomol. Society, p. 196.

animal matter. Here pursuit, search, or some equivalent thereto, is necessary for ensuring a due supply of food, and hence we find that the predaceous tribes of insects, like their analogues among beasts or birds, are more fitly organised for rapid movements than the lazy inactive herbivorous species. If this be the case with the perfect insects, there must be some other mode of obtaining their food by their predaceous larvæ (especially since it is during this period that feeding is the great object of an insect's existence), which are not furnished with sufficiently powerful organs of locomotion. We have described the extraordinary mask of the larva of the dragon-flies, which consequently is an instrument applicable for such purpose; and the raptorial structure of the fore-legs of many predaceous insects, the great strength of muscles by which these organs are moved, and the many strong spines with which they are armed, are in like manner auxiliaries, supplying the want of powerful locomotive organs. But there is still another class of predaceous larvæ which are compelled, in order to obtain their own food, to resort to actual stratagems for this purpose, which the more developed structure of the preceding insects rendered unnecessary. The constructions of the spider, and especially the manœuvres of the jumping spiders, so constantly to be noticed on every sunny wall, leaping from a considerable distance upon their prey, will also occur to our readers, but which we shall more especially notice elsewhere.

The larva of a somewhat rare British species of the Linnæan genus *Cimex* (*Reduvius personatus*), is asserted to feed upon the bed-bug; like it, it is found in houses, but its appearance is so extraordinary, that it is impossible to have the least idea that it is an insect, were it not for its slight and awkward movements. It covers itself completely with a coat of dirt and dust, so that it more resembles a lump of earth. Nevertheless the antennæ and rostrum are similar to those of the perfect insect, and enable us to decide what it really is; moreover, on touching it with the point of a pencil, its coat falls off at once, which, however, the insect soon again renews. In this dress it is enabled to approach its prey without their being alarmed at its coming.

There are, however, three species of insects belonging to as many distinct orders, *Coleoptera*, *Diptera*, and *Neuroptera*, which in their larva state exhibit a greater degree of instinct than any of the preceding, by the construction of pitfalls, in which they lay in wait for every stray insect which may be hapless enough to come within their reach. We have already described the burrow of the larva of the *Cicindela*, consisting of a long and tubular passage, at the mouth of which the voracious larva stations itself, its head just fitting the opening of this retreat with its jaws expanded, ready to seize on every passing insect. The two other species referred to are the ant-lion (*Myrmeleon*) and a fly (*Rhagio vermileo*). These construct large funnel-shaped burrows in sandy situations, at the bottom of which they take their station, ready to seize any ant or other insect which may chance to slip down the sides. The grub of the latter lies motionless at the foot of the burrow, and, snake-like, twines itself round its prey, piercing it with its strong hooks or mandibles. But the ant-lion is more wary, its form is most unprepossessing; it therefore buries itself in the sand at the bottom of its hole, leaving only its long curved jaws exposed; and it has the additional instinct, in case any of the insects which

fall down the sides of its trap should endeavour to escape, to bring them within its reach by a shower of sand. We must, however, reserve our details of their proceedings for the article MYRMELEON.

The various modes of active or passive defence adopted by insects, present us equally with many of the most interesting phenomena of insect instinct. Here we find Nature ever rich in resources, the smallest as well as the largest objects of the animated creation are equally beneath her care. We will run through the various orders of insects, and notice a few of the more remarkable of these peculiarities. We find the predaceous beetles well enabled to defend themselves, not only by the hard scaly covering of their bodies, and the powerful organs of their mouths, especially their strong and hooked jaws, but also by the emission of a black and foetid fluid, which is quite sufficient to ensure them from the attacks of their enemies. It is this fluid, which is occasionally volatilized on coming into contact with the air, that the bombardier beetle employs when in danger, as described in our article upon that insect. The predaceous water-beetles also, by similar emissions, but more particularly by their capability of flight in the air, swimming in the water, or creeping on the land, are enabled to avoid the attacks of enemies which might assault them in any of these elements. We have seen that many beetles, as the pill-beetles (*Byrrhidae*), the death-watches (*Anobium*), and the mimic-beetles (*Histeridae*), with many others, possess in a remarkable degree the power of counterfeiting death, by folding up their limbs and keeping them in a state of inactivity. Other beetles, by the similarity of their appearance to the sand or earth in which they reside, readily elude our observation, as in many sand heteromera. The emission of similar foetid scents and fluids by many other beetles, as the *Silphidae*, *Chrysomelidae*, and especially by the lady-birds, is a very ordinary means of defence; whilst the similarity in the colouring of others to the leaves, stems, or bark of plants and trees, is equally serviceable. The threatening aspect of some, as the devil's coach horse; the rapidity of the movements of others, as the *Halictæ*, joined to their minuteness, all tend to the same end. The larvæ of the *Cassidae* and *Crioceridae* cover themselves with a cloak formed of their own excrements, as described in our articles upon those insects.

In the *Orthoptera* we find great locomotive powers, as exhibited by the locusts and grasshoppers, whose strength in leaping is known to every schoolboy; but there are other insects belonging to the same order equally well defended, although their locomotive powers are but slight. Here we are to notice the walking leaf-insects and the walking stick-insects, objects which to an ordinary observer would appear but detached leaves or twigs rustling with every breath of air; but they have life, and Nature has given them their strange appearance with a view to its preservation, by deceiving those animals which might otherwise make them their prey. Nothing indeed can be more complete than the deception produced by these insects: the walking leaf is flat, semi-transparent, narrowed at the head, or stalk part of the leaf, the antennæ forming the stem, the abdomen is dilated at the sides, notched, like the margin of a leaf, and, to complete the resemblance, the wing-covers lie flat upon the back, forming by their union a straight central line, from which proceeds various oblique nerves, like the principal veins of a leaf. In the neuropterous and tri-

chopterous orders we find equally successful means of defence. We have already quoted a passage relative to the dragon-fly, from which it will be seen how completely, by means of wings, eyes, and mouth, it is enabled to escape its enemies. The delicate gauze-winged golden-eyed flies (*Hemerobius*), which seem too slight to encounter even a breath of air, come forth only at the dusk; they, moreover, emit the most disgusting scent; and, as a still further defence, they have the instinct to place their eggs out of danger, at the extremity of long and slender foot-stalks, and their larvæ cover themselves with a coat formed of the skins of their victims.

The *Phryganææ* encase themselves, in the larva state, in firm cases of earth, stones, shells, &c., fastened together; and thus their soft and fleshy bodies are secured from the attacks of fishes which, as every angler is aware, deem them a tempting morsel.

Who is there that has not experienced how well some of the insects of the hymenopterous order are enabled to defend themselves by the assistance of their sting? We surely need not describe the pain inflicted by this delicate instrument, which we have described at length in our article BEE.

The *Lepidoptera* are perhaps the most defenceless amongst insects, but even here we find many larvæ having instinct to enroll themselves in the leaves of plants, or to form for themselves tents or tubes of various materials for their abodes; whilst others, by the resemblance of their colours to the plants upon which they are found, or by the hairs with which they are clothed, are amply defended against their foes.

In the hemipterous order we find a very numerous tribe, composing the Linnæan genus *Cimex* (the bugs), able effectually to defend themselves by the emission of a powerful scent, which, although occasionally in some few species not disagreeable, is in general very disgusting.

In the *Hemiptera* many species, as the *Cercopidæ*, are enabled to leap to very great distances, thus avoiding their enemies; whilst some in the larva state conceal themselves beneath a curious coating of froth.

The *Diptera* do not present any very striking instances of insect defence; the rapidity of their motions, as well as those of insects composing the remaining order *Aphaniptera* (the flea), ought not, however, to be omitted.

From this review of the means of defence in the various orders of insects, it will be seen that distinct organs for active defence are not possessed by the majority of these animals, but that they are amply compensated by equally effective modes of counter-acting the attacks of their foes, consisting of powers of evasion, as rapidity of flight, strength in swimming, quickness in leaping, and velocity in running; or of repulsive powers, as emission of powerful odours, the hideousness of appearance, or simulating powers, whereby the appearance of death or other objects is assumed.

The various facts which we have now adduced will, we are convinced, be amply sufficient to prove how interesting is the study of this class of animals. Here all is motion, all manifests in the strongest degree the desire to prolong existence, and to perpetuate the countless insect tribes. The constant dread of destruction to which, from their small size, insects are so pre-eminently liable, and against which their instinct, in all states of their existence, is

brought into full action, is nevertheless necessary to preserve a just proportion between all the tribes of the creation. Here indeed we may safely believe—

All discord, harmony, not understood,
All partial evil, universal good.

Under whatever aspect we consider the little objects of our present consideration, if we admire the variety of their forms, the beauty of their colours, the diversity in their habits, the surprising development of their instinctive faculties, or the great part which they take in keeping up the harmonies of nature, we no longer marvel that so much care has been bestowed in their construction, or that so many good and learned men have endeavoured to study them in their various relations. Here we have seen structure and function admirably adapted to each other; here, in these tiny wheels of the great machine of the creation, we see developed and put in motion, even by a single glance of the unassisted eye, but still more admirably by the assistance of the microscope, the great resources of the Great and Almighty Machinist of all things. It is surely here, amongst the most perfectly organised tribes of the lower animals, as well as in the most stupendous objects of the animated world, that we trace “the Wisdom of God in the works of the Creation.”

“ Full nature swarms with life; one wondrous mass
Of animals or *atoms organised*,
Waiting the vital breath when Parent Heaven
Shall bid his spirit blow. The hoary fen,
In putrid streams, emits the living cloud
Of pestilence. Through subterranean cells,
Where searching sun-beams scarce can find a way,
Earth animated heaves. The flowery leaf
Wants not its soft inhabitants. Secure,
Within its winding citadel, the stone
Holds multitudes. But chief the forest boughs
That dance unnumbered to the playful breeze,
The downy orchard and the melting pulp
Of mellow fruit, the nameless nations feed
Of evanescent insects. Where the pool
Stands mantled o’er with green, invisible
Amid the floating verdure, millions stray;
Each liquid too, whether it pierces, soothes,
Inflames, refreshes, or exalts the taste,
With various forms abounds Nor is the stream
Of purest crystal, nor the lucid air,
Though one transparent vacancy it seems,
Void of their unseen people.
Let no presuming impious railer tax
Creative Wisdom as if aught was formed
In vain, or not for admirable ends.
Shall little haughty Ignorance pronounce
His works unwise, of which the smallest part
Exceeds the narrow vision of her mind?
As if upon a full-proportioned dome
On swelling columns heaved, the pride of art,
A critic fly whose feeble ray scarce spreads
An inch around, with blind presumption bold,
Should dare to tax the structure of the whole.
And lives the man whose universal eye
Has swept at once the unbounded scheme of things,
Mark’d their dependence so, and firm accord,
As with unfaltering accent to conclude
That this availeth nought? Has any seen
The mighty chain of beings lessening down
From infinite perfection to the brink
Of dreary nothing, desolate abyss!
From which astonished thought, recoiling turns?
Till then, alone let zealous praise ascend,
And hymns of holy wonder to that Power
Whose wisdom shines as lovely on our minds,
As on our smiling eyes his servant sun.”

Section 5. *Classification of Insects*.—We have now arrived at another branch of our subject, which, in many respects, is especially deserving the notice of the student, namely—the classification of insects, which has engaged the attention of naturalists in all ages. This portion of entomological science divides itself primarily into two points of view: firstly, an inquiry into the nature of the various relations exist-

ing amongst insects ; and, secondly, the mode of application of these relationships, either with a view to the construction of an arrangement most fitly adapted for the artificial bringing together of objects, so as to enable the memory with least difficulty to retain an idea of their various characters, distinctions, and names, or, with a higher view, of endeavouring to trace out, by the strict application of their relationships, the general plan by which the wondrous whole has been so beautifully arranged.

We have heard it maintained, by men whose views of natural history have been based upon a too partial examination of a few isolated species of some limited groups of animals, that, except in the relations existing between the sexes of a species, or the sexes of distinct species which might accidentally couple together, or between a predaceous insect and the insects upon which it preys, there can be no such thing as a relationship amongst insects. And this view of the subject is endeavoured to be supported by the argument, that the various species of the group which we term a family or genus, are totally independent of each other in all their relations of life, and that the annihilation of one species would in nowise influence the remaining species.

Now, all this may be, and much is certainly true ; but we submit, that this is a most partial mode of looking at the relations of animals, even in a natural history and economical point of view. We ordinarily employ the term relationship to designate that bond of community existing amongst the members of a family ; but there are numerous other species of alliances to which we may also give the general term of relations. And it is upon these undeniable relations, affinities, analogies, resemblances—call them as you will—that the classification of all animals are founded. And the more perfect our knowledge of any animal, in all its states, and in all its relations to all other animals, the more correctly are we enabled to give due weight to every peculiarity, whether structural or functional, which it exhibits ; and thus to trace its more or less contiguous relations with other animals. Again, if we look at the habits of insects, we find some exhibiting a similar predaceous economy ; others are vegetable feeders ; some attack particular species of animals ; others particular species of plants. Now each of these groups of species will, both from economy and from structure dependent upon economy, exhibit more close relations amongst their respective members than the species belonging to groups possessing opposite habits. Hence we may be induced to affirm, as has been done by a celebrated writer, Dr. Fleming, that we shall have as many systems of animals as there are variations of function. And thus, animals differing from each other, except in one isolated particular, are thought to be more nearly related together than they are to other species, to which, in all their other particulars, they are more intimately allied. But this also appears to us to be an equally incorrect and partial view of looking at nature. We have given too great a weight to such an isolated peculiarity : we will endeavour to illustrate this view of the subject by a reference to the recently published volume of the Count de Saint Fargeau, upon hymenopterous insects, in which we find the social character of these insects regarded as outweighing all other characters. The result of this is, that we have the ants, wasps, hive bees, and humble bees, united together, whilst the solitary wasps, and

the *Psithyri* (as noticed in the article HUMBLE BEE), and all other solitary or parasitic bees, are separated ; although their structure is in every respect almost identical, except in the organs, which are necessarily modified in the former, so as to be fitted for the duties of their social character. Now this mode of distribution appears to us to be erroneous, because too limited in respect to the great workings of the creature. These social habits, as we have seen, are but the results of a modification of the instinct for securing the development of the progeny of these particular species, whilst the great object of these insects in nature is overlooked. The solitary bee which burrows in rotten wood, and then forms its cell, exhibits as much instinct as the humble bee which is the foundress of a community. The wonders of the hive are but the exhibition of a more highly developed instinct in building and provisioning a nest. “ In rejecting from the family of the humble bees,” observes Saint Fargeau, “ the *Euglossæ* of Latreille (which that author had always inserted in the same group with the former), I may remark, that in a system (*dans un système*) the very long tongue may indicate a relationship between *Bombus* and *Euglossa*. But in a natural method (*une méthode naturelle*), this length *only* indicates that both are destined to gather honey from flowers having long and narrow tubes, although their habits are in other respects entirely different, as indicated by the structure of their hind legs*.” Here, however, the difference in habit between these two tribes of bees are only such as are immediately connected with their social or solitary nature, their entire structure being in other respects similar ; thus indicating that, except in this single circumstance, the entire system of the two groups must be as nearly as possible identical. Thus too much weight appears to have been given to the social conditions of the *Bombi*, and the characters of structure resulting therefrom. And, in like manner, the same remark may be applied to all classifications founded on the presumed superiority of an isolated character, independent of the question of its real value, as proved by the functions for which it is bestowed. And herein lies one of the great obstacles in the way of our tracing the real relationships of animals. Thus one author will maintain that the metamorphoses of insects are entitled to the first consideration ; and will hence insist that the all-devouring locust and the suctorial bug are closely allied together. Another will give the same weight to the organs of the mouth, and, denying the relationship between these two insects, will assert that the one is more nearly allied to the mandibulated *Neuroptera*, and the other to the suctorial *Lepidoptera* ; whilst a third will maintain the superiority of the wings, and thus bring the mandibulated *Hymenoptera* and the suctorial *Diptera* into contact. Now all these variations of classification do not prove that there are no such things as relationships existing amongst these tribes of insects ; but simply that the correct mode of applying the various characters, so as to correspond with their natural relationships, has not been discovered.

These relations, whether of structure or of habit, must have presented themselves to every one who has paid the least attention to natural objects. Let us take an example or two. We have already asked

*“ Hist. Nat. des Insectes Hyménoptères.”—Paris, 1836, p. 438.

our readers (in treating of the defences of insects), whether we need enter into detail, relative to the stings of hymenopterous insects, the pain arising from which must probably, at one time or other, have been experienced by all? Now every one knows that wasps, as well as hive bees, are stinging insects. This circumstance, then, insures the existence of one species of relationship (that resulting from functions); but if we take the trouble to notice these two insects more particularly, we shall find they possess numerous other characters in common. Both are provided with membranous wings of unequal size; both are social in their habits; both are similarly organised in the structure of their antennæ, and in the number of their abdominal rings. Here, then, we find so many points of resemblance, that we at once admit the existence of a relationship, or similarity so close, that it cannot have escaped the most indifferent observer. This intimate kind of relationship is termed an affinity. But there is another kind of relationship which must have been equally observed by every observer of nature. We have already taken the wasp and the bee as our guides, and here again they will serve our purpose. Whoever has walked, during the heat of the day, in any woody situation, must have observed various bee and wasp-looking insects hovering about in the sunbeams, and darting away on being approached with an astonishing rapidity. These are not, however, bees nor wasps, neither do they belong to the same order as these insects, although they are sometimes called drones, when seen settling upon flowers; which name is also given to the male honey bee. We have given figures of these insects, in order to exhibit their resemblance, in the article ENTOMOLOGY (page 430). Here there is no real affinity, no resemblance extending through a series of particulars. Habits, structure, wings, legs, antennæ, are all different, when examined with precision; and yet, on a casual glance, the general appearance of the two insects is so similar. This distant kind of relationship is termed an analogy. Further; as there are instances in which a similarity of appearance may thus exist without any real affinity, as regards the structure of essential organisation, so, on the other hand, are there numerous instances in which a direct affinity, resulting from similarity of the essential organs, exists between two insects, although their general appearance be quite unlike each other. Of this masked kind of affinity, numberless instances might be produced. Thus an heteromorous insect, related by affinity to *Tenebrio* and *Helops*, so closely resembles some of the predaceous beetles, that Fabricius called it a *Carabus*; and Mr. Kirby has described several allied species under the names of *Adelium*, *Caraboides*, *Calosomoides*, and *Licinoides*. We have further to notice, that as there are more than one species of hive bees dispersed over the globe, so there are other social species of wild honey bees: in like manner there are as many species of wasps and hornets. Each of these groups of species constitute a certain series; and thus we discover some of the links of a chain extending throughout nature. Now it is impossible to adopt these views without, at the same time, admitting that all these beautiful and harmonious affinities and analogies could be bestowed upon animals without any regard to some fixed system.

“Order is heaven’s first law,”

and the naturalist must be blind, indeed, who cannot

trace in the beautiful gradations of form, and the various relationships of animals, the marks, slight enough in too many cases, of a universal system, wherein just regard is paid to every peculiarity, and every structure shown in juxtaposition with allied structures, none being excluded. This is termed the *natural system*; but in what manner the knowledge, of this system is to be attained, whether, as appears generally to be supposed by a review of mere structural peculiarities, or by selecting the general functions of each species or by taking into consideration its geographical range—whether the system be a linear series or a circular one—whether it be supposed to resemble the intricacies of a map* or a sphere; whether it be resolvable throughout its divisions in a binary (Dr. Fleming and Haworth), trinary (Swainson), quaternary (Fries), quinary (Mac Leay), or septenary manner (Newman); whether we confine ourselves to the now existent species, or have regard to the countless multitudes of extinct species; whether by means of any of these proposed modes or any other, it must be evident that natural history, and especially philosophical natural history, is too new a subject to allow any one to assert that his system, and his only, is superior to all the rest. Great progress has been made of late years in this field; but how great is the yet untrodden portion we have to labour at unceasingly; and he who, by a minute analysis of any animal, enables us to solve any dubious point connected therewith, does more for the elucidation of this much abused natural system than the greatest and most ingenious theorist who has yet taken the subject in hand.

The celebrated Cuvier, whose laborious researches and acute reasoning made such vast strides in the philosophy of natural history, and effected as great a revolution in received opinions as was ever brought about by one man in any science, was fully sensible of the correctness of these opinions. He laboured not to support system, but to discover the truth; and the further he advanced, seemed the more convinced that he did not know enough to enable him to form a system. And if this were the case with the greatest comparative anatomist who ever lived, how truly must the same remark be made of those who, without having ever touched the dissecting knife, sit down to construct, out of the workings of their own fanciful and ingenious brains, the natural system. Speaking of such theories, Cuvier, a little before his death, said, “I have sought, I have set up some myself, but I have not made them known, because I have ascertained that they were false, as are all those which have been published up to this day. I affirm still more; for I say that in the present state of science it is not possible to discover one, and it is for this reason that I persevere in my observations, and that I continue to publish them. This perseverance only can lead to the truth. We ought to labour, not with the object of supporting a theory, because then the mind, being preoccupied, will perceive only that which favours its own views; our labours should be for the object of discovering the truth.”—Memoirs of Cuvier. The writer of the present article, who had the honour of a personal acquaintance with this celebrated man, can testify how completely these were his real sentiments.

* Linnæus, in his *Philosophia Botanica*, thus speaks of the natural system as exhibited by plants, “*Plantæ omnes utrinque affinitatem monstrant uti territorium in mappa geographica.*”

Taking into consideration the immense number of species of insects, which, as we have already observed, so far exceed all the other animal sub-kingdoms; it must, however, be evident, as Mr. Mac Leay observes, that it is here, owing to their myriads of species, that the mode in which Nature's chain is linked—a mode, the knowledge of which comprises all knowledge in natural history—will be most evident, and therefore most easily detected. This same circumstance also is attended with another consequence. If the species of insects (and, indeed, of any tribe of animals) be so numerous, and their natural distribution so difficult of attainment; and yet, nevertheless, if we would retain and extend the knowledge which we already possess, either of their structure or habits, it must be evident that this can only be done by distributing their groups in the most convenient mode for reference. This may, and, indeed, must be done in an *artificial method*; that is, we select certain constant characters which may, nevertheless, possess but very little influence upon the habits of the animal, and which, indeed, in many cases, compel us to separate groups which we know to be naturally allied by affinity with each other. Thus we separate the wasps from the bees, because the former fold their upper wings longitudinally when not flying; and thus we divide the beetles according to the joints of the tarsi, although in some instances direct affinities are thereby separated.

Nevertheless, the great advantages resulting from an artificial method are so obvious, that we find them admitted by persons who do not hesitate to reject, as an absurd fancy, the existence of a natural system. These advantages will appear the more evident when we investigate the actual number of insect species. Our great and pious naturalist, John Ray ("le premier véritable naturaliste pour le règne animal," as the equally great Cuvier has styled him), in his "Wisdom of God," published at the close of the seventeenth century, tells us respecting the number of British insects: "The butterflies and beetles are such numerous tribes, that I believe in our own native country alone, the species of each kind may amount to 150 or more. The fly kind (if under that name, we comprehend all the flying insects, as well such as have four, as such as have but two wings, of both which kinds there are many subordinate genera), will be found in multitudes of species to equal, if not exceed, both the forementioned kinds. The creeping insects that never come to be winged, though for numbers they may fall short of the flying or winged, yet they are also very numerous. Supposing then there be a thousand several sorts of insects in this island and the sea near it; if the same proportion holds between the insects natives of England and those of the rest of the world, as doth between plants domestic and exotic (that is, as I guess near decuple), the species of insects on the whole earth (land and water) will amount to 10,000, and I do believe they rather exceed than fall short of this sum." Subsequently, however, in consequence of having discovered a greater number of English moths and butterflies, he was induced to consider that the total number of British insects might be about 2000, and those of the whole earth 20,000. Mr. Stephens, however, in the most perfect catalogue of insects ever yet published, devoted to the British species, has introduced not fewer than 10,000 native species, and perhaps 2000 or 3000 remain unnoticed.

Linnaeus, in the edition of 1761, of the Fauna of Sweden, described 1700 species; and in the twelfth edition of the Systema Naturæ, the entire number of these animals (Swedish and exotic), with which he had become acquainted, amounted to about 3000; but during the last half century the investigation of insects has so much progressed, that Mr. Mac Leay, in his *Horæ Entomologicæ*, published in 1821, stated that there were certainly more than 100,000 of the annulose animals (nearly synonymous with the Linnaean insects), preserved in the various collections. The latest insect census is, however, that of Dr. Burmeister, who states that there are in Germany about 6000 plants (including *Cryptogamia*), and more than 12,000 insects; so that, if this proportion be constant, the number of known insects, according to the 60—70,000 known plants, will amount to 120—140,000 species; and if the opinion of the latest botanists be adopted, that about one-third of the collective species of plants are known, the number of species inhabiting the earth would amount to 360—420,000 species. Kirby and Spence, indeed, averaged six species of insects to one phanerogamous plant, and considering there may be 100,000 species of phanerogamous plants in the world, they obtain the number of 600,000, or more probably 400,000 species of insects. There are computed to be 28,000 species of beetles in the royal collection at Berlin; and from the supposed superiority of the extent of the coleopterous order, Dr. Burmeister considers that the actually known species of insects may be thus distributed:—

Coleoptera	.	.	36,000
Lepidoptera	.	.	12,000
Hymenoptera	.	.	12,000
Diptera	.	.	10,000
Hemiptera	.	.	4,000
Other insects	.	.	4,000

Mr. Stephens's British catalogue shows the following proportions; but it must be observed, that the attention lately bestowed upon the minute *Hymenoptera* and *Diptera*, have raised their numbers very considerably:—

Coleoptera	.	.	3300
Lepidoptera	.	.	1838
Hymenoptera	.	.	2054
Diptera	.	.	1671
Hemiptera	.	.	605
Other insects	.	.	544

Now it must be evident, that unless some convenient and easily applicable mode of classifying these vast masses be adopted, the mind will be compelled to remain in a state of the most profound darkness. We will not, however, dwell upon this subject, but refer our readers to the article CLASSIFICATION.

The annulose, or insect sub-kingdom, is divisible into the four classes above mentioned; viz., *Crustacea*, *Arachnida*, *Ametabola*, and *Ptilota*, or winged insects; which last Mr. Mac Leay separates into two distinct classes, as mentioned in our observations on the mouth of insects; namely, *Mandibulata* and *Haustellata*. These classes are again divisible into orders.

Linnaeus adopted the structure of the wings as affording the characters of his orders, which were as follows:—

1. *Coleoptera*.—Wings four, the upper pair crustaceous with a straight suture (beetles and earwigs).

2. *Hemiptera*.—Wings four, the upper pair semi-crustaceous and incumbent (bugs, locusts, tree-hoppers, plant-lice, &c.).
3. *Lepidoptera*.—Wings four, imbricated with scales (butterflies, moths).
4. *Neuroptera*.—Wings four, membranaceous, anus unarmed (dragon-flies, &c.).
5. *Hymenoptera*.—Wings four, membranaceous, anus armed with a sting (bees, wasps, ants, saw-flies, &c.).
6. *Diptera*.—Wings two, halteres two in the place of the posterior wings (flies).
7. *Aptera*.—Wings none (spiders, crabs, centipedes, fleas, &c.).

We have shown above that the possession of wings is the chief characteristic of the *Ptilota*, which may therefore be regarded as the type of the other annulose animals, that is, we may consider them as the furthest removed (as concerns their organisation), from the other animal sub-kingdoms; hence we find, that the orders or first general divisions of insects are characterised from the structure of the wings (*πτερον*, a wing); and hence this Greek word, together with some other prefixed to it, is employed as the name of orders. We have thus *Coleoptera*, sheath-winged, *Neuroptera*, nerve-winged, &c.; but it soon became evident, that the characters of the wings were too general; and Fabricius, a disciple of Linnæus, fell into the opposite error of regarding the variations of the mouth as alone affording the most satisfactory distribution of insects.

The system of Fabricius introduced a number of new orders, which he was pleased to name classes; and to which, in addition to such of the Linnæan orders as he retained, he gave a series of exceedingly harsh names, founded upon the structure of the mouth, as follows:—

Insects with masticating mouths.

Two pairs of jaws.

Elcutherata. Maxillæ palpigerous, uncovered (beetles).

Ulonata. Maxillæ palpigerous, covered with a galea (locusts, mantes, &c.).

Synistata. Maxillæ palpigerous, connate with the lower lip (lace-winged flies, &c., with the white ants and sugar lice).

Piezata. Maxillæ palpigerous, distended, thin, coriaceous (bees, wasps, saw-flies, &c.).

Odonata. Maxillæ palpigerous, horny, toothed, labium not palpigerous (dragon-flies).

Mitosata. Jaws and maxillæ not palpigerous (centipedes, &c.).

A pair of jaws resembling scissors.

Unogata (scorpions and spiders).

More than two pairs of jaws.

Polygonata. Jaws closed by the lower lip (sea and wood lice, *Oniscus*).

Kleistagnata. Jaws external, closing the mouth beneath (crabs).

Exochnata. Jaws external, but covered by the palpi (lobsters, &c.).

Insects with suctorial mouths.

Glossata. Mouth with a spiral tongue (butterflies, moths).

Rhyngota. Mouth with a membranous jointed sheath, inclosing horny lancets (bugs, tree-hoppers, &c.).

Anthiata. Mouth with a soft unjointed proboscis (flies, lice, and mites).

As the Linnæan system, founded upon the wings, was found to violate nature by uniting masticating and suctorial insects, so the Fabrician system was, in some respects, even more artificial, as when the wingless sugar-lice, which undergo no metamorphoses, were introduced amongst the metamorphic lace-winged flies, &c., and the lice and octapod mites (*Acari*) were united with the two-winged flies. The system of Fabricius has met with but few followers, except in Germany, his chief merit consisting in his definition of a great multitude of new species. To the labours of the French naturalists, Cuvier, Latreille, and Lamarck, we are mainly indebted for the great advances made towards a more natural mode of distribution, wherein the natural affinities of the various groups are more or less recognised. It would occupy too much time to trace the gradual improvements, or suggestions for improvements, which have been made during the present century, in which Entomology has made such rapid strides towards perfection. We shall, therefore, content ourselves with translating for the student the characters of the various orders of metamorphic insects, given in the last work of Latreille, the *Cours d'Entomologie*, published shortly before his death, and which are generally adopted. Latreille, however, has introduced the spring-tailed insects (*Thysanoura*), and lice (*Anoplura*), at the head of the class of insects which, as above stated, we have, with MacLeay, united with the *Ametabola*, as they undergo no metamorphoses.

- I. Wings none, metamorphoses complete (perfect), larva apod, pupa inactive, mouth formed of an inferior syphon, directed backwards, composed of a bi-valved articulated sheath, inclosing a sucker of three setæ, with two scales at the base, body very compressed, formed for leaping. Insects parasitic (fleas).

Order, *Siphonaptera*.—Mr. Kirby's name, *Aphaniptera*, ought to be retained in preference either to Latreille's name, or that of *Suctoria*, given to the flea by De Geer.

- II. Wings, sometimes, however, obsolete; eyes faceted, and occasionally ocelli.

1. *Elytroptera*.—Posterior wings, covered by the anterior, which are either entirely or partly crustaceous or coriaceous.

- A. Mouth with upper jaws, and lower jaws; elytra of an uniform consistence.

Order, *Coleoptera*, characterised by,

Elytra entirely crustaceous, always horizontal, with a straight suture; wings folded cross-wise; external lobe of the maxillæ not helmet-shaped; metamorphoses complete (pupa incomplete), beetles.

Order, *Dermaptera*,

Elytra entirely crustaceous, horizontal with a straight suture; wings folded transversely and partly longitudinally, so as somewhat to resemble a fan; maxillæ with the terminal lobe helmet-shaped; two strong pincers at the posterior extremity of the abdomen in both sexes; demi-metamorphoses (pupa complete and active), ear-wigs.

Order, *Orthoptera*,

Elytra (tegmina) coriaceous, deflexed or inclined, in some horizontal, and folding on each other at the internal edges in the others; wings longitudinally folded throughout their entire length; maxillæ, with the terminal external lobe, helmet-shaped; abdomen terminated by articulated appendages in both sexes in some; in the others, the abdomen furnished with

an external ovipositor; demi-metamorphoses (pupa complete and active, locusts, grasshoppers, mantes, cockroaches).

B. Mandibles and maxillæ none; a rostrum, or sort of proboscis, formed of an articulated sheath, inclosing a sucker of four pieces; elytra (hemelytra) membranous at the extremity in some species; demi-metamorphoses, except in a few (pupa complete and active),

Order, *Hemiptera*.

2. *Gymnoptera* (naked wings).

No elytra, four or two naked wings.

A. Four wings.

a. Upper and lower jaws; wings generally transparent, not farinose; tegulæ, (scales placed at the base of the upper wings) small and tubercular.

Order, *Neuroptera*, with the

Wings thickly reticulated; the posterior of the same size as the anterior, or longer or larger: no exerted ovipositor in the majority; no sting, metamorphoses various.

Order, *Hymenoptera*, with the

Wings horizontal, with large areas, or simply veined, the posterior smaller than the anterior; maxillæ often valvular, laterally sheathing the tubular lower lip, and forming a species of rostrum (promusculis) more or less elongated; an exerted ovipositor, or an anal sting in the majority of the females.

b. Mandibles rudimental; maxillæ replaced by a spiral rostrum (spiritrompe), formed of two fillets, tubular, and rolled up in a spire, united between two labial palpi; wings farinose, tegulæ (pterygodes), large, epaulette-shaped, turned backwards,

Order, *Lepidoptera* (butterflies, moths).

B. Two wings.

Order, *Rhipiptera* (Mr. Kirby's name, *Strepsiptera*, must be retained instead of *Rhipiptera*), with

Two pseudhalteres (prebalanciers), or small crustaceous moveable bodies in the shape of small twisted elytra, placed in front of the wings, which are folded fan-wise; mouth with two setiform pieces, crossed like a pair of mandibles.

Order, *Diptera*, with the

Wings extended, and accompanied in the majority by two small moveable bodies, in the form of balancers, situated behind the wings; rostrum bent at its base, and generally terminated by two fleshy lips, inarticulate, inclosing a sucker formed of a variable number of setæ (flies).

The first of the above described orders, *Aphaniptera*, Kirby, is, in various respects, most nearly allied to the *Diptera*. It will also be observed that the suctorial *Hemiptera* are introduced into the middle of mandibulated insects. These difficulties are necessarily attendant upon our endeavours to arrange our primary groups in a linear series, in which it is impossible to combine all these relations of groups. Thus, if we remove the *Hemiptera* from the situation assigned to it by Latreille, and place it amongst the suctorial insects, we shall violate its relations with the *Orthoptera*, caused by the similarity in its metamorphosis, and in the structure of the wings.

Mr. Kirby has further separated the *Phryganidæ* from the *Neuroptera*, under the name of *Trichoptera*. Mr. Haliday has added another order in the last number of the Entomological Magazine, named *Thysa-*

noptera, formed of the genus *Thrips*, Linn. M. Laporte has also proposed several other orders in his *Etudes Entomologiques*.

The reader will find these various orders treated upon at length in their alphabetical situations. It is here only necessary to observe, that each, according to its extent, is divisible into a greater or less number of groups, and gradually decreasing in value, until our arrival at the families (of which we have spoken more at length under our article *CANCERIDÆ*) genera, and species; the last of which, according to the opinions of some authors, is the only absolute division existing in nature.

In every extensive genera it has been found serviceable to introduce minor divisions, which greatly facilitate the acquisition of knowledge. We have, however, already dwelt upon the nature of these minor groups in our article *CANCERIDÆ*, and shall only observe, that in the opinion of some authors (as for instance, Mr. Vigers, in the *Zool. Journal*) their existence ought not to be admitted; or if they present sufficiently distinctive characters, they ought to be regarded as genera, and the next higher group of which they form a part, as sub-families. That the gradual approximation of form in the most extensive groups, where, for instance, it must be admitted that the series, from the number of species, is evidently least unbroken, prevents us from assigning such distinctive limits to our groups, whether of genera (that is speaking theoretically) or sub-genera, as shall comprise those particular species, in which the characters of distinct genera are blended together, cannot be denied. And the great genus of *Carabidæ* (*Feronia*) has frequently been cited. But still even in these kind of groups we find various types of form, which in the typical species of each minor group are so well marked, that if the genus were less numerous in species, entomologists would not hesitate to consider them as so many distinct sub-genera. But by many naturalists the great chain of nature is regarded as formed upon this very mode of confluent characteristics; and were we to admit, in those most extensive and consequently, as we may well suppose, most perfect series of species, the non-existence of genera or sub-genera, we should be compelled to admit still further, that there is no such thing in nature as any other distinct division than that of species; and it would be as correct, in such point of view, to assert that a butterfly is a beetle, as it would be to say that a *Pæcillus* is a *Steropus*. "It appears to be the opinion of most modern physiologists," observe Messrs. Kirby and Spence, "that the series of affinities in nature is a concatenation or continuous series, and that though an hiatus is here and there observable, this has been caused either by the annihilation of some original group or species, in consequence of some great convulsion of nature, or that the objects required to fill it up are still in existence, but have not yet been discovered; and this opinion is founded upon a dictum of Linnæus's '*Natura saltus non facit*.' If this dictum be literally interpreted, according to the evident meaning of the word *saltus*, few will be disposed to object to it, since both observation and analogy combine to prove that there must be a regular approximation of things to each other in the works of God; and that, could we see the whole according to his original plan, we should find no violent interval to break up that approximation; but if it be contended that in this plan there is no difference in the juxtaposition of the lowest

groups or individuals, and never any interval between them, I think we are going further than either observation or analogy will warrant. Were this really and strictly the case, it seems to follow that every group or individual species must, on one side, borrow half its characters from the preceding group or species; and on the other, impart half to the succeeding. (Query, whether every real species or group has not some one or more peculiar characters, which it neither derives from its predecessor nor imparts to its successor in a series?). But one of the most evident laws of creation is variety, and if we survey all the works of the Most High, we shall nowhere discover that kind of order and symmetry that this strict interpretation implies. The general march of nature, therefore, seems to say, that there must be varying though not violent intervals in the series of beings, or, in other words, some conterminous species or groups have more characters in common than others."

Very few words will suffice upon the nature of species, a term employed to designate those groups of animals which (save as respects sexual distinctions) possess a perfect conformity in their characters, which indeed they have uninterruptedly possessed since the first establishment of species. The oldest records of natural history, where sufficiently clear to be relied upon, show us that in the species which are therein described or figured, not the least variation has taken place in them. Were not this the case, indeed, there would be grounds for the belief that there are new species of animals produced, which, as Ray says, would certainly now and then, nay very often, happen were there any such thing. But, as in the higher animals, the species of insects are liable to variation, as every collector is well aware; thus, some moths, which have the ground of their wings of a pale colour with dark markings, will be found to have dark wings with light marks. Variations in size are equally common, and entomologists deem it expedient to retain in their collections suites of individuals of each variable species, from the smallest to the largest; sometimes, indeed, the latter are many times larger than the former, a circumstance often occurring in wood-feeding insects. In general also male insects are much smaller than the females. The reader will also bear in mind that this variation in size is not the result of increased growth after arrival at the winged state, and that the small individuals will by and by attain the size of their partners. This is quite contrary to every principle of insect physiology. It is in the larva state that the eating and growing of these animals chiefly takes place. And it would be as requisite for the imago to cast its horny envelope in order to increase its size, as it is for the larva to do the same thing; again, it must be self-evident that without the sloughing, the external envelope could never, from its consistence, undergo the slightest change. Moreover, the change which the digestive organs undergo in the passage from the larva to the imago states, sufficiently proves the same fact. But species often vary even in structure, not indeed in any of the more important organs, but in the various arms with which they are furnished. This is especially the case with the cornuted species, and those which have the mandibles very greatly developed. Here in many instances there appear to be a series of individuals intermediate between the fully developed species and the females, which are generally destitute of these appendages. This we have noticed in many

species of lamellicorn beetles, and in some of the staphylinidæ (*Siagonium quadricorne*). The Rev. Mr. Burrell also observed it in another species of the same group, *Bledius armatus*, of which he describes a variety with horns shorter than the head, although usually longer, and which he is disposed to regard as a neuter, an opinion also entertained by Mr. Haworth, who considers that such neuters are far more frequent, even in the hymenoptera, than hitherto imagined. (Entomological Transactions.) Besides these, which appear to be casual occurrences, there likewise exist what have been termed *permanent varieties* in many species, the individuals of which are found in situations different from the ordinary type of the species, and it has been considered that these variations have originated somewhat in a similar manner to the varieties of domestic animals; but this may certainly be doubted, because in most domesticated insects, the common house-fly, disseminated as it is over the whole surface of the globe, and the hive bee, we find not the least liability to vary; and if this be not the case with these species, we can hardly attribute the production of varieties in species, which are in nowise subject to the rule of man, to a similar cause.

The characters by which species are distinguished are very variable, partaking indeed, in this respect, of the peculiarities which we have noticed in our observations upon generic and sub-generic groups. In very extensive genera the distinctions of species are so minute, that it requires the most practised eye to separate them; and indeed there are some groups, the species of which are so intricately blended together, that no two entomologists are agreed as to their distinctness. The genus *Nothophilus* (a genus of small *Carabidæ*), affords an instance of this. Until very lately it was supposed to consist of only two British species, Mr. Curtis, however, added another; Mr. Waterhouse, increased the number to eighteen, in a monograph published in the Entomological Magazine; whilst Mr. Stephens has subsequently reduced this number to six. The characters which supply specific distinctions are also very variable, size, sculpture, colour, markings, locality, general forms, are all employed, and it often happens that a character, which in one group of insects would be deemed of sufficient value to characterise a genus, is in others only serviceable as a specific mark of distinction; thus in the genus *Rhipicera* (a group of exotic beetles, with beautiful pectinated antennæ); these organs vary in the number of their joints; whereas we have seen, that in a whole section of hymenoptera (*Aculeata*) the same number of joints runs throughout the whole.

In describing species of insects it is usual to give a short character embracing the most striking characteristics of the species. This is ordinarily in Latin, that language being universally regarded as peculiarly adapted to science, being universally understood wherever science exists; indeed the neglect of this plan, which we often notice in French and German, and sometimes in English authors, shows a disregard to a settled and most convenient custom, enabling persons unacquainted with those particular languages to identify, in some degree, a species, although the more extended description may be written in either of these or any other tongue. It is usual also to add the length of the body and expansion of the wings, these measurements being taken in inches and lines, which are the tenth parts of an inch.

To each species of insect two names are given, namely, a generic, and a specific one; as, for instance, *Acherontia atropos*, or the death's-head moth, an insect which we now mention in order to refer to our article thereon for some observations upon the advantages resulting from the employment of specific names over the old verbose mode of distinguishing species. The names of species are ordinarily derived from, or are, Latin words, expressive of some specific peculiarity. Thus we have *Phalæna mori*, the silk-worm moth, or moth of the mulberry-tree; *Melolontha solstitialis*, the summer cockchaffer; *Mutilla Europæa*, the European mutilla; *Carabus violaceus*, the violet-coloured carabus, &c. &c. From the great advantages resulting from the specific names, it is highly essential that they should be unchangeable. The Linnæan names have consequently and constantly a pre-eminence, the great Swede having first introduced them into natural history. In like manner, the name imposed upon any new species by the original describer thereof, is retained in preference to all subsequent ones; unless, indeed, some signal error should have occurred in the imposition of the original name. Here, however, it is necessary that we do not permit our love of change to overcome what is really useful. It has been said, for instance, that if a specific name be derived from a character which is afterwards discovered to be a generic one—as, for instance, *Leistus spinibarbis*, *Loricera pilicornis*; or, if such name be derived from a sexual character—as, for instance, *Eucera longicornis*, *Eulophus ramicornis*, *Eulophus damicornis*, *Eulophus pectinicornis*, &c.; or, again, if a name has been employed indicative of the habitation or place of capture of an insect, and it is afterwards discovered that the supposed habitation was merely accidental—as, for instance, *Curculis lapathi*; or it be discovered that the insect is not confined to the supposed locality—as, for instance, *Agonum Austriacum*, *Raphidia Londinensis*—that in all, or any of these cases, it is necessary that new specific names should be given to these insects. We, however, see no necessity for any such step: *Loricera pilicornis* is known throughout the entomological world under that name. The object for which specific names are given to animals is therefore completely obtained; and if we would change this name, and give it another strictly referable to some specific peculiarity, we cannot see what there is to prevent a would-be reformer of names from throwing down the hundreds of names, derived from the heathen mythology, given to insects, and substituting others of his own in their stead. Let us not, however, be understood to advocate error, even though long perpetuated.

The name of the author by whom an insect was first described and named, is generally placed in an abbreviated manner after the specific name. Thus the insect described by Linnæus under the name of *Carabus intricatus*, is spoken of as *Carab. intricatus*, Linn. Sometimes, however, when an insect has been removed from the genus in which it was originally placed, the new generic name is written, and the name of the person by whom the removal was made is added after that of the species. Thus the *Cychnus rostratus*, Fabr., was originally the *Tenebrio rostratus*, Linn.; but Fabricius removed it to the genus *Cychnus*. Here, however, an evident injustice takes place, as the name of the original describer of a species ought always certainly to follow

his own name. This difficulty might be obviated in two ways: either by writing the names of the last-mentioned insect, for example, thus—*Cychnus*, Fabr., *rostratus*, Linn.; or, more correctly, thus—*Cychnus rostratus*, Fabr. (*Tenebrio*, p. Linn.)—the letter *p* standing for the word part.

Generic names are, for the most part, derived from the Greek, and are generally indicative of some peculiarity of the genus. Thus the genus of bees, *Macrocera*, derives its name from two Greek words, *macro*, long, and *keras*, a horn; the antennæ being very long in the males. In like manner we have *platycerus*, broad-horned, &c. &c. Many of the Linnæan generic names are, however, destitute of any direct application to the insects which such genera contain, this author having employed the old natural history names, usually to be met with in the early authors in the most senseless manner. Indeed, this could not be avoided in many instances, from the vague manner in which the names had been employed; and hence Linnæus, anxious to enlist them all again into the service of natural history, hesitated not to employ them for objects which probably had not the least connexion with those to which they had been applied by the ancients. The universal adoption of the Linnæan nomenclature throughout the zoological world has rendered these blemishes too trifling to cause any confusion to originate in consequence of their adoption. For the like reason, and in order to prevent the equally great confusion which would arise by employing several names for the same animal, naturalists have adopted the plan of retaining that first proposed, unless it should happen to be evidently incorrect, the subsequently proposed names sinking into synonyms.

We will now, in conclusion, lay before the reader a short alphabetical list of the chief entomological authors, with a concise notice of their chief works, which are deemed of standard merit, and which no entomological library should be destitute of. There are a great number of names which we have necessarily omitted, the following being the most eminent only of the writers upon this branch of natural history.

ARISTOTLE.—The father of natural history. He lived about the year 330, B. C., and devoted considerable attention to the natural history of insects, which he separated, under the name of *Entoma*, from the *Crustacea*, which he called *Malacostraca*, and divided into three sections: 1. Those with wings, *Pterota*, or *Ptilota*; 2. those with occasionally wings; and, 3. those destitute of wings. In the first were comprised various subdivisions, admirably constructed, including the present orders, *Coleoptera*, *Diptera*, which two names are still retained; and others corresponding with the *Hemiptera*, *Lepidoptera*, *Diptera*, &c. In the second were placed the ant and the glow-worm; and in the third, all wingless insects.

AUDOUIN (Mons. Victor).—Professor of entomology at the Jardin des Plantes, Paris; author of numerous detached entomological memoirs; but especially known by his invaluable researches upon the structure of the thorax.

BOISDUVAL (Mons.).—A French entomologist, especially distinguished for various works upon *Lepidoptera*; the most valuable of which is his *Natural History of Lepidopterous Insects*, the first volume of which has just appeared, forming part of the *Suites à Buffon*.

BURMEISTER (Dr. Hermann).—A young Prussian entomologist of the highest promise. His works exhibit profound erudition, an admirable ingenuity and correctness in the anatomical details, and the greatest carefulness in the elaboration of his materials. He has published various memoirs of great merit; but is best known by his *Handbuch der Entomologie*, or *Manual of Entomology*, a very useful introductory work, in which a great quantity of materials, scattered over numerous miscellaneous works, is brought together, and admirably digested. We have already alluded to the translation of the first volume of this work, by Mr. Shuckard. The second volume treats upon the descriptive portion of the *Hemiptera* and *Homoptera*.

CRAMER.—A Dutch author, distinguished for his beautiful work, in quarto, upon exotic butterflies, in five volumes; commenced in 1779.

CURTIS (John).—An English entomologist, and author of *British Entomology*, or *Illustrations and Descriptions of the Genera of Insects found in Great Britain and Ireland*; the most elegant periodical work hitherto published. Each genus is illustrated by a coloured figure of one of the species, and with the details of the mouth and antennæ. A figure of a plant is added, upon which, in many cases, the insect is found.

CUVIER (George Leopold Christian Frederick Dugobert, Baron).—The greatest zoologist of modern days; born in 1769, in Alsatia; died at Paris, in 1832. In his *Traité Élémentaire*, and *Anatomie Comparée*, he carefully investigated the comparative structures of the annulose animals, and separated the *Crustacea* as a class from insects. In his celebrated work, *Le Règne Animal* (The Animal Kingdom), the details of the entomological portion were executed by Latreille.

DE GEER (Charles, Baron).—A Swedish naturalist; born in 1720; known by his admirable *Mémoires pour servir à l'Histoire des Insectes*; a work in seven quarto volumes, with a great number of plates, in which the most ample details of the structure and metamorphoses of a vast number of species are given. Mac Leay calls him the prince of entomological authors.

DEJEAN (M. Le Comte).—A French entomologist, and the possessor of one of the most extensive collections of *Coleoptera* ever yet made. He has published, 1. a catalogue of his *Coleoptera* (the second edition is now in course of publication); 2. a description of the species of predaceous land beetles (*Cicindelidæ* and *Carabidæ*), in six octavo volumes, and (in conjunction with M. Boisduval) a description of European beetles, now in course of publication.

DUFOUR (Mons. Léon).—A French author, still living; distinguished for the great extent of his anatomical investigations upon insects, illustrated by figures drawn by himself. They are published in numerous foreign periodicals, especially in the *Annales des Sciences Naturelles*.

ESSENBECK (Dr. Nees Von).—Professor of natural history at Breslaw; author of various memoirs upon the minute parasitic *Hymenoptera*; of which his recently published "*Hymenopterorum Monographiæ*" are the most valuable.

FABRICIUS (Johann Christian).—A German entomologist, pupil of Linnæus, and professor at Kiel in Holstein; born 1747; died, 3rd of May, 1810, aged

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63*, especially distinguished as the founder of the Cibarian mode of distribution of insects (established upon the structure of the mouth); but more deservedly known and cited as a most extensive describer of species of insects. His chief works are *Entomologia Systematica*, in four vols., 8vo., commenced in 1794, and in which those species of all orders with which Fabricius had become acquainted in his numerous voyages, are described. He visited England several times, and was on terms of friendly intercourse with Sir Joseph Banks, &c. Subsequently he published as distinct works the *Systema Eleutheratorum* (*Coleoptera*); *Antliatorum* (*Diptera*); *Piezatorum* (*Hymenoptera*), and *Rhyngotorum* (*Hemiptera*, *Homoptera*).

FALLEN.—A Swedish entomologist, chiefly distinguished by his works, entitled *Diptera Sueciæ*, and *Hemiptera Sueciæ*, &c.; in which the species of these and some other orders found in Sweden are carefully described.

GEOFFROY.—A French author, contemporary with Linnæus; especially remembered on account of his introduction of the variations in the number of tarsal joints, as affording sectional groups in the order *Coleoptera*. His chief work is entitled "*Histoire abrégée des Insectes*," &c. Paris, 1764, 2 vols., 4to.

GRAVENHORST (Dr. J. L. C.).—Professor of Natural History at Breslaw, author of various works upon the *Brachelytra* (*Staphylinidæ*), and also upon the *Ichneumonidæ*. *Ichneumonologia Europæa*, in three large octavo volumes, is his most valuable work.

GUÉRIN (Mons. F. E.).—A French naturalist and artist, author of numerous detached Entomological Memoirs, with beautiful illustrations; but especially distinguished by his *Iconographie du Règne Animal*, in which types of all the leading genera of animals are figured, with an infinity of details of structure.

GYLLENHAL (Leonard).—Author of a very valuable work in four volumes, octavo, entitled *Insecta Sueciæ*; but comprising only the beetles found in Sweden. His descriptions are admirable.

HAWORTH (Adrian Hardy).—An English entomologist, founder of the old Entomological Society, and author of *Lepidoptera Britannica*, a work consisting of careful descriptions of all the species of lepidopterous insects with which the author was acquainted. Died in 1834.

HUBER, F.—A Swiss entomologist, distinguished for his interesting series of *Observations upon the Economy of the Bees*.

HUBER, P.—Equally distinguished with his father for his extensive series of *Observations upon the Economy of the Ants*. His *Memoirs* have been translated into English.

HUBNER.—A German entomologist, author of a valuable work containing figures and descriptions of European *Lepidoptera*, (*Der Sammlüg Europaischer Schmetterlinge*), in quarto.

JURINE (Louis).—A Swiss entomologist, author of a valuable work upon the *Hymenoptera*, in which the structure of the veins of the wings was employed to characterise the genera, entitled *Nouvelle Méthode de classer les Hyménoptères et les Diptères*. Vol. 1, *Hyménoptères*. Geneva, 1807, quarto.

* There is some confusion in entomological works as to these dates. Those given above are derived from information given to the writer hercof by Dr. Fabricius of Kiel, son of the entomologist.

KIRBY (Rev. W.).—The father of English entomologists, author of a great number of detached Memoirs, and especially distinguished by his Monograph upon the English Bees, a most invaluable work, and a model for all subsequent monographers. He likewise published, in conjunction with W. Spence, an Introduction to Entomology, in four volumes, 8vo., a work of the greatest research. His Memoirs upon the Strepsiptera, the Genus Apion, and his Bridge-water Treatise, are also to be noticed.

KLUG (Dr. Frederick).—A Prussian Naturalist, conservator of the insects of the Berlin Royal Museum, particularly devoted to the Hymenoptera, and distinguished by his Memoirs upon the Tenthredinidæ (*Blattwespen*), published in the Berlin Transactions, and his Jahrbucher der Entomologie, &c.

LAMARCK (Jean Baptiste de).—A French naturalist, chiefly distinguished for his works upon the invertebrated animals, of which the most valuable is the Histoire Naturelle des Animaux sans Vertèbres, présentant les Caractères généraux, &c., in seven vols., 8vo. Paris, 1815. The class *Arachnida* was separated from the insects by this author.

LATREILLE (P. A.).—Professor of Entomology at the Jardin des Plantes, Paris. Born 29th of November, 1762. Died 6th of February, 1832. One of the most distinguished of modern entomologists, whose writings for nearly half a century have tended in the highest degree to improve the science which he so ardently loved. From the publication of his Précis des Caractères génériques des Insectes, published in 1796, until that of his Cours d'Entomologie, he ceased not to labour towards the accomplishment of a natural classification of insects, and to a perfect investigation of the general structure. His most valuable works are Genera Crustaceorum et Insectorum, in four volumes, 8vo., and his Histoire générale des Insectes, in fourteen volumes, 8vo.

LINNÆUS (Carl von).—A Swedish naturalist of the greatest celebrity. Born 24th of May, 1707, at Roeskild in Sweden, and distinguished as the founder of modern Zoological Classification and Nomenclature. His works appeared in succession from 1735 to 1770, each being advantageously remodelled. His Systema Naturæ, in which all the animals, plants, and minerals with which the author was acquainted, and his Fauna Sueciæ, in which the animals of Sweden were described, are most constantly cited. Of the former work twelve editions appeared in the lifetime of the author; the last of which was published in 1766, and which is considered as his most valuable work.

LYONNET (Pierre).—Author of one of the most elaborate treatises ever published, bearing the title of "Traité de la Chenille qui rouge le Bois de Saule," in which the anatomy of the larva of the goat-moth, *Cossus ligniperda*, is described and illustrated in the most complete manner. It was published in 1760, in one volume, 4to., containing 615 pages and eighteen plates. The anatomy of the pupa and imago, but in a comparatively imperfect state, have been lately published.

MAC LEAY (Wm. Sharp).—Author of the Horæ Entomologica, a most remarkable and profound treatise, in which the relations of animals are treated upon in a peculiar manner. The work also contains a classification of the Lamellicorn beetles. He has also published the first part of the Annulosa Javanica, containing a portion of the *Coleoptera* collected in

Java by Dr. Horsfield, whose *Lepidoptera Javanica* may be considered as a continuation of the same work.

MACQUART (Mons. J.).—A French entomologist, who has confined his attention to the dipterous insects, and has published numerous Memoirs upon those found in the North of France, in the Transactions of the Natural History Society of Lille. Likewise two volumes containing A General System of Dipterology, with plates, in the series of works termed Suites à Buffon.

MARSHAM (Thomas).—Author of Entomologia Britannica (London, 1802), of which only the first volume, containing the *Coleoptera* of Great Britain, was published. Being, in consequence of the difficulty of intercourse with the continent during the war, unacquainted with the labours of his contemporaries, many of the species which he described had previously received names, so that those which he proposed have been rejected.

MEIGEN (J. W.).—A German author, who has confined his attention to the dipterous insects of Europe, which he has carefully described in his Systematische Beschreibung der bekannten Europ. Zweiflug. Insekten. Aix-la-Chapelle, 1818, six volumes, 8vo. During the last autumn he exhibited to the writer hereof a complete series of drawings of all the species which he has described. It is greatly to be hoped that this valuable collection will be published.

OLIVIER (Guillaume Antoine).—Author of various Entomological Memoirs, and especially of the Entomological articles in the great French Encyclopédie Méthodique, in which great numbers of new species are described; and likewise of the Histoire Générale des Insectes, of which work, six quarto volumes, with many plates containing the *Coleoptera* only, have appeared.

PANZER (G. W.).—A German entomologist, author of many works, but especially known by his Fauna Insectorum Germaniæ initia, a very extensive work, in which each species is figured. There were 110 numbers of this work published during the lifetime of the author, each containing 24 plates; and since his death, Ahrens and Herrick Schaffer have commenced supplements.

PAYKULL.—A Swedish author, published in 1800 a valuable work, in 3 volumes, 8vo., upon the *Coleoptera* of Sweden, the descriptions of which are very exact. He also previously published detached Memoirs upon the *Carabidæ* and *Staphylinidæ*, *Curculionidæ* and *Histeridæ*.

PICTET.—A Swiss author, who has lately published a very complete work upon the phyganea or caddice flies, (order *Trichoptera*, Kirby).

RAY (John).—The first true systematist and author of The Wisdom of God, in the Works of the Creation, and of a quarto volume, entitled Historia Insectorum, London, 1710, and a tract with the title Methodus Insectorum, seu Insecta in Methodum aliqualem digesta.

REAUMUR (Rene Antoine Erchault de).—Born in 1683, at La Rochelle. He was a most astonishing genius, devoting his attention to various branches of philosophy; but the most elaborate of his works was that published under the title of Mémoires pour servir à l'Histoire des Insectes, in 6 volumes, 4to., containing 3,672 pages, and 267 plates. This immortal work is so constantly cited in every work of

entomology, in which the habits and manners of insects are introduced, that it would be useless to say anything in its praise. Its distinguished author died in 1757.

REDI (Francisco).—An Italian naturalist, who, by his work published at Florence, in 1668, entitled *Experimenta circa Generationem Insectorum*, completely overthrew the doctrine of spontaneous generation.

ROSEL VON ROSENHOFF (August Johann).—A German naturalist, author of various works upon entomology, and particularly a beautiful work in 4 volumes, 4to., with many plates, in which the habits and transformations of many interesting species of insects are recorded. It appeared in 1746, and was continued until 1761.

SAVIGNY (Jules Cæsar).—A French naturalist, distinguished by his elaborate researches into the comparative structure of the mouths of insects and other annulose animals, and author of *Mémoires sur les Animaux sans Vertèbres*, and of the plates which illustrate the annulose portion of the magnificent French work upon Egypt, undertaken by order of Napoleon. The labours of this distinguished naturalist have cost him his eye-sight.

SAINT FARGEAU (M. le Comte Lepelletier de).—A French entomologist, who has confined his attention to the *Hymenoptera*, distinguished by his *Monographia Tenthrédinetarum*, by numerous articles in the last volume of the *Encyclopédie Méthodique*, and by his work upon the *Hymenoptera* in general, forming a portion of the *Suites à Buffon*.

SCHONHERR (C. S.).—A Swedish entomologist, distinguished by an elaborate work, in course of publication, upon the *Curculionidæ*, in 6 volumes, 8vo., and which, in fact, forms a continuation of his *Synonymia Insectorum*, a work in 4 volumes, 8vo., confined to the synonymy of the *Coleoptera*.

STEPHENS (James Francis).—An English entomologist, and author of a most laborious, systematic, and synonymical Catalogue of English Insects, of all the Orders, and of Illustrations of British Entomology, consisting of descriptions thereof. Of the latter work, the coleopterous, lepidopterous, and orthopterous portions are now completed, and the *Hymenoptera* are in course of publication.

SWAMMERDAM (John).—One of the fathers of entomology, chiefly distinguished by his *Biblia Naturæ*, a work in 2 volumes, folio, with 53 plates, in which the transformations of many insects were completely traced from their various stages. This work, therefore, in conjunction with that of Redi, completely established the real nature of insect metamorphoses. It has been translated into English by John Hill, whose edition was published in 1758.

WIEDEMANN (G. R. W.).—Professor of Natural History at Keil, and successor of Fabricius, whose attention has been chiefly confined to exotic *Diptera*. His chief work, *Aussereuropäische Zweifl. Insekten*, is in 2 volumes, 8vo., and was published in 1828.

INULA (Linnæus). A large genus of annual and perennial herbs, chiefly natives of Europe. They bear yellow discous flowers, and belong to *Compositæ*. They thrive in any common garden soil.

IODAMIA (of De France) is a fossil shell reunited to the genus *Birostrites*, of which it may be considered only a species.

IPOMŒA (Linnæus). A very extensive genus of annual and perennial climbing plants, from almost all parts of the world. They are nearly allied to con-

volvulus, and some of them bear remarkably handsome flowers. Class and order *Pentandria Monogynia*, and natural order *Convolvulaceæ*. They are, in cultivation, usually trained to columns or on trellis-work, and are easily managed plants, whether in the stove or greenhouse.

IPS (Herbst). A genus of coleopterous insects belonging to the section *Pentamera*, and family *Engidæ*, having the body of an oblong-oval form, and depressed, with the third joint of the antennæ longer than the second, and the club large and rounded. These insects are generally found under the bark of decayed trees, where they feed upon sap, for lapping which the terminal lobe of the maxillæ is elongated. The species are chiefly confined to Europe, and are generally ornamented with red or yellow spots upon a black ground. The British species (of which four have been described, but to which number another, from the neighbourhood of Edinburgh, captured by the Rev. Mr. Little, must be added) are generally rare, and do not exceed one-fourth of an inch in length. The type of the genus is the *Silpha 4-pustulata* of Linnæus, which is of a black colour, with four irregular red spots on the elytra.

IRIDEÆ, a natural order of plants, comprising already above thirty-six genera, and between four and five hundred species. Many of the most beautiful gems of flora are found in this order, namely, *Iris*, *Ixia*, *Crocus*, *Tritonia*, *Gladiolus*, *Antholyza*, *Tigridia*, &c. &c., they are all plants of peculiar interest as to the modifications of structure they present, both in the organs of vegetation and fructification. They form a very natural assemblage, in all of which, excepting the crocus, the leaves are equidistant, and rise in general from that kind of stem called a *rhizoma*, either extended, as in iris, contracted as in crocus, or still less developed, as in those which have fibrous roots; that is, where the inferior caudex is at once divided from the crown into fibres without forming even the plate of the crocus, which is called a *lecees* if very thin, or a *combis* if collected into a thicker mass. The *Irideæ* are easily known by the outward dehiscence of their erect anthers. The germen is inferior and three-celled, the placentæ axial, the ovules many, and the albumen hard or horny. Although the crocus alone has aromatic stigmas, a great uniformity prevails among all these plants in the properties of other parts. Their fleshy root stocks contain much fecula, impregnated with an acid bitter principle; hence, both *Iris Germanica* and *pseudacorus* have been employed as purgatives and emetics; and *I. Florentina*, from its agreeable odour, to make tooth and hair-powder, and to keep up the discharge from issues. Pallas says, that the roots of *I. dichotoma* are eaten in Siberia; and, according to Thunberg, the Hottentots roast and eat the roots (or *rhizomas*?) of *I. edulis*. The seeds of *I. pseudacorus*, when roasted, form a very excellent substitute for coffee.

IRIDINA (Lamarck). Some slight difference in the formation of the hinge of these shells induced Lamarck to separate them from the genus *Anoden*, to which they have since been united by more recent writers; the substance of the shell is also constantly more solid than that of the *Anoden*. It has a brilliant rose-coloured, peachy interior, particularly iridescent, and is found in the rivers of warm countries. Until the more extended researches of recent travellers, this shell was of great rarity; and in Du Bois' Epitome of Lamarck's arrangement, only two examples are named: one in the present Provost of Eton's

splendid cabinet, the other in that of the late Earl of Tankerville.

IRIS (Linnæus). A beautiful and very numerous genus of herbaceous perennials, belonging to the class and order *Triandria Monogynia* of Linnæan botany, and to the natural order to which it gives a title, viz. *Irideæ*; one or other of the species are seen in every cottage garden; the generality being hardy, and increase themselves spontaneously. Some of the foreign sorts require the care of the florist, as the Persian and all the bulbous-stemmed sorts. The French national emblem, *Fleur-de-lis*, is found here.

IRON. The most important varieties of this mineral will be described under the general article **MINERALOGY**.

ISATIS (Bauchin), a genus of herbaceous annuals and biennials, natives of Europe, belonging to *Cruciferae*. One of the species is found wild in England, viz. the *I. tinctoria*, and cultivated as a dye, under the name of woad. It was, before the introduction of indigo, a plant of considerable commercial importance, and extensively cultivated in Somersetshire, especially about Glastonbury, which town received its name from the Celtic word *glas*, signifying blue. The ancient Britons are said to have painted their bodies with the blue colour obtained from this plant.

ISOCARDIUM (Lamarck; **CHAMALOR**, Linnæus). The molluscs constituting this genus have been separated from the genus *Chama* of Linnæus, and the genera *Cypricardia* and *Cordita* of Lamarck's first arrangement of conchology, not only on account of the peculiar shape of the cardinal teeth, which principally guided his classification, but also on account of the singular and graceful curvature of the umbones, which are spirally turned on either side each valve in the form of what is called familiarly a fool's-cap, from which is derived the trivial English name of the type of this genus, and is found in the European Seas; the others inhabit the China and Indian Seas. The *Isocardia*, first described by Moltke, was a few years since of great rarity and price, but is now within the reach of every collector's purse. The general description of shells of this genus is its being equivalve, heart-shaped, globose, the umbones distinct, and spirally recurved to the side of each valve; two flat primary teeth, one of which is bent and inserted under the umbo; a lateral prolonged callosity or lengthened tooth; and the ligament external and forked on one side. De France enumerates six fossil species, one of which is precisely analogous.

ISOLEPIS (R. Brown). A genus of annual and perennial grass-like plants, belonging to *Cyperaceæ*. Common in British ditches and bogs, as well as in similar places in foreign parts.

ISOPODA (Latreille). An order of crustaceous insects belonging to the sub-class of *Edriopthalmous malacostraca*, and embracing the Linnæan genus *Oniscus*, with the numerous sectional and generic groups separated therefrom. It is distinguished by the hard envelope of the body, the eyes not raised upon footstalks, the body divided into a series of nearly equal sized and generally flattened segments, and the legs of nearly equal size, and fourteen in number, the anterior pairs not being cheliferous, or armed with large claws. These characters will readily distinguish them from the leaping shrimps (*Gammarii*, &c., order *Amphipoda*), and from the order *Læmodipoda*, as well as from the great division of *Podopthalmous crustacea*. The legs are terminated by a short curved hook or

nail; the under surface of the abdominal portion of the body is furnished with flattened appendages or plates, having the edges fringed with fine hairs, serving, as is supposed, for respiratory organs, and covered by a larger pair. The body is generally flattened and of an oval form, being broader than it is thick. The internal pair of antennæ are almost obsolete in some of the most aberrant species of the order which are not aquatic. The females carry their eggs for a considerable period in a membranous bag, under the breast or between the pectoral scales. The young when hatched are very similar in form to their parents, and undergo scarcely any other change than that of an increase of size produced by the occasional shedding of the outer envelope of the body. The greater number of species inhabit the water, some of them being parasitic upon fishes. The terrestrial species also require a certain degree of moisture, in order to preserve their branchiæ in a fit state for respiration.

Latreille divides this order into six sections as follows:—

1. *Epicarides*—destitute of eyes and antennæ, legs unfitted for locomotion. This section comprises only a single genus, *Bopyrus*, Latreille, which is often to be found under the shell of the prawn.
2. *Cymothoidæ*—four antennæ terminated by a multi-articulate slender thread, fore legs generally furnished with strong hooks. These are parasitic upon fishes. Genera, *Serolis*, *Cymothoa*, *Ichthyophilus*, *Æga*, and many other genera established by Dr. Leach, including the *Limnoria terebrans*, which is so destructive in some of our ship yards.
3. *Sphæromidæ*—antennæ four, abdomen with two articulations, swimmerets composed of two plates, the lower being moveable. Genera, *Zuzara*, *Sphæroma*, and other genera of Dr. Leach.
4. *Idoteidæ*—antennæ four, placed on the same line, internal small, abdomen with three articulations, destitute of lateral swimmerets. Genera, *Idotea*, *Stenosoma*, *Arcturus*.
5. *Asellidæ*—antennæ four, inserted in two lines, abdomen composed of a single articulation, without lateral swimmerets, and terminated by two long and slender styles. Genera *Asellus*, *Oniscoda*, &c.
6. *Oniscidæ*—internal antennæ almost obliterated, abdomen six-jointed with two or four terminal appendages; some are terrestrial. Genera, *Ligia*, *Oniscus*, *Porcellio*, *Armadillo*. A figure of the last named genus will be found in our article **CHILOGNATHA**.

ISOPOGON (R. Brown). A genus of evergreen shrubs from New Holland, belonging to the class *Tetrandia* and the natural order *Proteaceæ*. These are ornamental plants, but require much care in keeping healthy, owing to their being easily injured by too much water at the root. They may be propagated by cuttings, but with difficulty, if they get too damp.

IVY, a well-known British plant. See **HEDERA**.

IXIA (Linnæus). A beautiful flowering genus of Cape bulbs, belonging to the *Irideæ*. The best soil for the ixias, of which there are many splendid species, is a mixture of sandy loam and leaf-mould, or moor-earth. They require no water after they have done flowering. They should be fresh potted in October, and set in a cold frame well protected from frost.

When they have commenced growth they may be removed to the greenhouse to perfect their flowers, in doing which they must be regularly watered. A cold pit, or elose under a south wall, is favourable to their growth, provided they be defended against frost. They are propagated by offsets.

IXORA (Linnæus). A genus of fine flowering evergreen shrubs, found every where in the eastern parts of Asia. Class and order *Tetrandria Monogynia*, and natural order *Rubiaceæ*. Generic character: calyx small, four-lobed; corolla-tube long; limb regular, four-lobed, spreading. Stamens almost setting on the throat of the limb, alternating with the lobes thereof. Style lengthened out, stigma double. Berry two-celled, and two-seeded. This is one of the finest of our stove plants, and when grown in a moist heat, kept free from insects, and properly attended to, and not plunged in the bark-bed, always flowers in perfection. It is increased by cuttings.

JABIRU. A genus of American birds chiefly inhabiting the marshy places of the tropical parts of that continent; and bearing some resemblance to the herons, but much more to the storks. See the article **MYCTERIA**.

JACAMAR (*Galbula*). A genus of *Zygodactylic*, or climbing birds, which reside chiefly in trees, but are not so decided climbers as many of the order. They are in so far related to the kingfishers; and, like them, they have the anterior toes in great part united, so that, though several naturalists rank them with the zygodactylic birds, the real structure of their feet is syndactylic. As is the case with the kingfishers their tarsi are short, their feet altogether of feeble structure, and evidently not intended for performing any very important office in the economy of the birds. They rest upon trees, and build their nests in the lower branches; but they feed on the wing, chiefly, if not exclusively, upon those insects which hover over water and humid earth; and thus the birds are found only in marshy places, which in such situations are very unfavourable to human life; and therefore, as is the case with our own kingfisher, the habits are not so well observed, because not so open to observation as those of many other birds. In finding their food, they keep to the air, and do not fish, even by twitching fishes out of the water; and thus their habits do not require the same smoothness of plumage as the kingfishers, but they have all a good deal of metallic lustre in their feathers.

The structural characters of the genus are: the bill long, straight, or slightly bent toward the tip, slender, four-sided, and without any notch or tooth; the nostrils placed laterally at the base of the bill, of an oval shape, and covered with a naked membrane for the posterior half of their length; the feet very short, with three or four toes, of which two are always turned to the front and united as far as the third joint; the wings of mean length, the first three quills increasing in length by stages, but the third shorter than the fourth and fifth, which are the longest in the wing; the tail consists of twelve feathers, of which the two lateral ones are very short.

These structural characters indicate a peculiarity of action in the birds, which confines them to localities which are rather limited; as they must find their food without any very severe degree of labour. The feet, as we have already observed, are quite inefficient for any very important active purpose; and they are

not adapted even for that slow climbing motion from branch to branch which characterises the parrot tribe and other tree climbers; and as little can they cling to the upright bole of a tree, like the woodpeckers, or run along like the creepers, and other birds which are active in catching insects upon the bark. As little does the structure of their wings suit them for coursing their insect prey through the air, by rapid motions and sudden wheelings and evolutions, such as those made by the swallows and bee-eaters. Their organs of motion are all fitted for short flights, and frequent ascendings and descendings; and this kind of structure and of flight naturally confines them to those situations in which slow-flighted insects are found in sufficient abundance. Of course it is only in those rich and humid parts of the tropical countries which may be said to be in a state of perpetual production, without any winter's repose, and free from drought, as take place in the less humid districts of the same climates, that these birds can be in a situation properly adapted for them. Hence it does not appear that they migrate to any considerable distance. Our knowledge of them is, however, far from perfect, and we must receive with caution many of the accounts which have been given of them. They inhabit the deepest recesses of the forests, and thus they are but rarely seen; and different from very many of the birds of tropical forests, they are not much heard. Their voice is very feeble, being merely a sort of subdued hissing; and even this is practised only during the breeding time, which we believe is not confined to any particular season of the year, which licence indeed extends to very many of the forest birds of tropical countries. Generally speaking, they remain at perfect rest, and in perfect silence, on the twigs or leaves of the trees, always as solitary individuals, and never in flocks, or even in societies of any extent. From those resting places they sally forth with very rapid but very short flight, in order to capture those insects which are sporting over the water. They never rise to any great elevation when on the wing; and their short flights are taken in straight lines, generally sloping upward or inclining downward, for either of which they are remarkably well adapted by the peculiar structure of their wings and tail. It has been supposed that some species at least of the jacamar deposit their eggs in the nests of other birds, something after the manner of the cuckoo of Europe, but the fact is not clearly established. All the known species are understood to be natives of America only. They admit of division into two sub-genera, in consequence of the different number of toes in each.

JAMAICA JACAMAR (*B. Galbula grandis*) is a native of that country after which it is named. It is about ten inches in length. The upper parts are golden green, with reflections of copper and bronze. The first quills are brown: the upper tail-coverts green, the lower ones ash colour with violet reflections. The feathers at the opening of the gape are copper red; the chin white; the throat and under parts red; the bill and feet black, the former nearly straight and resembling that of the king-fisher. This one has two toes turned to the front and two to the rear, the latter free, but the former united.

LONG-TAILED JACAMAR (*G. paradisea*). This species is longer than the former, but the greater length is in the tail rather than the body. The upper part is blackish brown with a play of colours; the top of

the head is brown ; the chin, the sides of the head, the breast, and all the under parts are blackish, but marked with white spots on each side of the belly ; the quills and tail feathers are violet black with a play of colours ; and the two middle feathers of the tail are considerably longer than the rest, and each one toward the side is shorter than the one within it. The bill and feet are black. The colours of the female want the reflections which characterise the male ; and the two middle feathers of the tail are also shorter in that sex.

YELLOW-BILLED JACAMAR (*G. flavirostris*) has the upper parts of golden green with very brilliant copper coloured reflections. The front and region of the eyes blackish brown with bright metallic lustre. The primary quills brown with the basal parts and the inner webs yellow. The tail feathers regularly staged, with the two middle ones golden green, and the remainder russet. The chin is whitish, the throat reddish, the breast copper green, the under parts bright red ; and the bill yellow at the base, but black at the tip. The colours of the female are much duller than those of the male. The length of this species is about eight inches.

WHITE-BELLIED JACAMAR (*G. leucogaster*) is also about eight inches long, and has the whole bill, and also the feet black. The upper part golden green ; the sides of the head dull blueish green ; the quills and tail feathers golden green, margined with iridescent blue. The throat and belly are white, but all the rest of the under parts are golden green. The bill and feet are black.

GREEN JACAMAR (*G. viridis*). This species is also of the same size as the two preceding ones. It has the upper part of a very rich and brilliant golden green ; the front and region of the eyes blackish brown ; the top of the head, and the edges of the quills and tail feathers deep blueish green ; the rest of the primaries blackish. The chin ash-colour, the throat white, and all the rest of the under parts russet. The under parts of this one are, however, subject to considerable varieties of colour in different individuals.

THREE-TOED JACAMAR (*G. tridactyla*). This species differs from the former in size, being only seven inches in length ; and it differs more in the structure of its feet, by having only three toes, two to the front and one to the rear. On this account it has sometimes been classed with the bee-eaters, and at other times regarded as a separate genus. But its structure and habits are not like those of the bee-eaters, nor does it appear that there are any good grounds for regarding it as a distinct genus, at least in so far as its general manners are concerned. The upper parts are blackish brown with green reflections ; the feathers on the crown, and at the base of the bill, are blackish brown, with produced margins of a reddish colour to their webs. The primary quills and tail feathers are brown, margined externally with golden green ; the secondary quills are brown, with some mottling of yellow ; the sides of the head are brownish ash ; the chin yellow : the throat black ; the middle of the breast and the belly white, with a rosy tint ; the flanks and under coverts of the tail blackish, mottled with russet ; and the bill and feet are blackish. Such are the few particulars at present known respecting this genus of birds ; but as the very peculiar countries which they inhabit are beginning to be explored with equal zeal and ability, we may soon expect more complete accounts of them and their fellows of the woods.

JACANA (*P. Parra*). A very peculiar, and by no means uninteresting genus of birds, belonging to Cuvier's *Macrodactylic*, or long-toed family of *Echassiers*, or stilt birds ; and forming the most typical or characteristic genus of the family. In their habits they are somewhat allied to the rails and water-hens of our temperate climates ; but they are all natives of warm countries, and possess the power of running lightly upon aquatic plants and herbage in far greater perfection than any of our birds.

The birds of this genus are very strikingly distinguished from all the other walking birds by the great development of their feet, which are in all the species, and in every part of the structure, very large and strong in proportion to the size of the bird. The tibiae are very long, stout, and naked of feathers for the greater part of their length ; the tarsi are also very long and strong ; and these two bones are, together, as long as the whole body of the birds, if not longer. The most remarkable part, however, is the great development of the toes and claws. These toes are four in number, three to the front, and one to the rear, all articulated at the same height on the tarsus, and perfectly free, or without membranes, to their very basis. They are furnished with very long claws, very little bent, and tapering to points, which are exceedingly sharp ; and this peculiarity of the claw is more remarkable on the hind toes than on any of the rest. From this produced form and extreme sharpness of the claws, the French have given these birds the fanciful name of surgeons, though it does not appear that they exercise those keen weapons in any kind of phlebotomy, or in doing violence to any creature whatever ; though, as we shall presently see, this very singular formation is by no means without its use in the economy of the birds. The body, as is the case in all birds which have a running or walking habit rather than a flying one, is borne with the axis nearly horizontal ; and such is the extent of base obtained from the great production of the toes and claws, that it extends as far as from the breast to the posterior extremity of the body. The bill is of moderate length, not exceeding that of the head. It is straight, slender, slightly compressed, rather enlarged at the point, flattened at the base, where it extends into a sort of plate on the forehead, nearly in the same manner as in the coots, which also belong to this family. The mandibles are of unequal length, the lower one being the shorter. The nostrils are lateral about the middle of the bill, oval, and open through and through. The wings are of mean length, or rather long for the size of the bird ; the first and second quills are of equal length, and the third is often the longest in the wing. One of the most remarkable appendages of the wing is a large horny spur, slightly curved, and very sharp-pointed, which is placed on the turn of the wing, and which might be used as a rather formidable weapon ; but whether it ever is so used has not been determined. This formidable armature of the feet and the wings has, however, led some to conclude that these birds are of a pugnacious disposition : but the very reverse seems to be the case ; for those who have had the best opportunities of observing them in a state of nature, represent them as being very peaceable birds, and very much attached to each other, especially the pairs, which show a very strong reciprocal affection. The birds are at all times difficult to approach, because of the lightness and agility with which they run upon the

floating leaves, and also through the tall aquatic grasses, and the ease with which, when necessary, they can throw themselves so far into the air as to be able to get on the wing. The great elasticity of their toes, and the rapid contraction of these by the bendings of the upper joints of the limbs, are the means by which this is effected. The keen points of the claws, too, enable them to take hold of a stem or a leaf, so as to form a point of support with very little pressure. The spur on the wing is not of such apparent utility, but it may also assist the bird in holding on upon the aquatic herbage until it has acquired a footing. Any one who has observed with what swiftness, neatness, and lightness, the common water-hen runs along a brook, when there is only here and there a straggling leaf or stem to afford support, can readily imagine how much more fleetly these birds, whose feet are so much better organised for such an office, can make their way over the waters; and consequently how difficult it must be to obtain a sight of them, more especially as the places which they inhabit are not the most tempting for human visitors. They belong to places where the growth and the production of food for them is constant; and therefore their breeding-time is not fixed to a particular season. From the attachment which the pair show for each other, and the fact of a pair being generally met with, it has been concluded, not only that the males are strictly monogamous, but that the unions are formed for life. When one is occupied, the other is always watching, and instantly gives the alarm-cry when danger is near; or if the alarm-call is given, not from the actual appearance of danger, but from the apprehension of it, the one which is called to responds that all is safe by a sort of subdued and murmuring cry, which has something very pleasant in it. During the day, these birds remain very silent, unless when they are disturbed by unwelcome visitors; but during the night, when they are in motion, their cries are heard at a great distance, and the sound is by no means agreeable. Their nests are formed in the thick tufts of marsh plants, in a very similar manner to those of the long-toed birds of Europe. They are built of rushes and other coarse aquatic plants, of which a great quantity is collected, and placed sufficiently high for being above any ordinary inundation. The hatch consists of four or five eggs, of a greenish colour, and mottled with small spots of dark brown.

The birds of this genus were once supposed to be natives of America only; but they are found in the marshy parts of all tropical countries. In central Africa, in India, in the Oriental Isles, as well as all the richer parts of tropical America. They are birds which are peculiarly characteristic of the places which they inhabit; and as they are rarely found in situations which are but occasionally covered with water, and which form the proper pastures of the cranes and storks, they are not much given to migration. Within their localities, their flight, when they do take the wing, is rapid; but they do not rise to great heights, or fly over long distances.

Their proper function in nature appears to be that of cleaning the leaves of aquatic plants, of which there are vast numbers in tropical countries, from insects and other small animals which are not available either to flying or swimming birds. They take up the waters as a pasture, when the fly-catchers, bee-eaters, and other birds which can use the wing rapidly, there leave off; and they quit them at that particular stage where

they become the pastures of ducks and divers, and other birds which seek their food at the bottom, or submerge in the free waters. We shall now very briefly notice the principal species, the habits of all of which, in so far as they are known, appear to be very much alike.

THE FAITHFUL JACANA OR CHAZA (*P. Chavaria*) is a South American species, and by no means rare either in the country bordering on the Caribbean Sea, or in the humid parts of Paraguay. It is about the size of a dung-hill cock, and stands about a foot and a half high. The toes are long, the legs are of a tawny colour, and the bill is dirty white; a red membrane extends over both sides of the base of the bill to the temples, in the centre of which the eyes are placed. The irides are brown; twelve blackish feathers, about three inches long, form a crest on the nape, and the neck is furnished with black down. The body is of a brownish colour, and the wings and tail are brownish black. The wings are furnished with two or three spurs on the turn, which are about half an inch in length. The under parts are dull brownish black, as are also the feathered parts of the tibiae, which are however short in proportion to the naked parts. The toes are so very long, that they are apt to get entangled with each other when the bird walks on level ground at a faster rate than its usual marching pace, which is slow and measured. It is found about the rivers and inundated places, where it is understood to feed indiscriminately upon small animals and vegetable substances. According to the accounts, its instinct of attachment is turned to use in some parts of South America, where the inhabitants keep a single tamed one for the purpose of accompanying their domestic poultry, which it defends from birds of prey by means of the spurs on its wings. In these cases it is said never to desert its charge, but to accompany the poultry in all their movements, and defend them with the greatest bravery.

CHILI JACANA (*P. chilensis*). This species is described as not being so aquatic in its habits as most of the species, and it resides on the low and rich plains, but not exactly in the marshes; and its food consists of insects, worms, and other small ground animals. It measures about ten inches in length; the upper parts are of a rich chestnut colour; the forehead, head, neck, breast, abdomen, and larger wing-coverts, are pure black; the sides, rump, and coverts, and feathers of the tail, are bright chestnut red; the quills of the wings are clouded with green and yellow, and have black tips; the lesser coverts are blackish, with white tips; the under coverts of the wings are reddish, with the webs of the feathers loose and flocculent; the bill is yellow, covered for the basal half of its length by a red membrane, which proceeds as far as the angles of the eyes; and then bending upwards, forms two lobes upon the forehead, which are not attached to the forehead, but bend in part over the base of the bill. Those appendages indicate a considerable connexion between these birds and poultry. The eggs are four in number, of a tawny colour dotted with black, and they are a little larger than those of a common partridge. The male and female are always found together near the nest, and they fight with great bravery in defence of their eggs and young. When they perceive any person approaching the place where their nest is situated, they at first conceal themselves in the grass or other herbage, but their watchfulness is not thereby abated;

and when they discover that the enemy has found out the nest, they dart upon him with the most determined resolution, and fight boldly in defence of their charge. During the day, where they can have the advantage of sight, they are perfectly silent, and they do not utter their cries during the night without some cause of alarm; but if any one passes, or any unwonted noise is made, their ear appears to be as quick by night as their eye is by day, and they instantly give their call, which is audible at a considerable distance. On this account, some of the Indian tribes employ them, during their wars, as sentinels against nocturnal surprises of the enemy; if even a single foe approaches, let him tread how lightly soever, the jacana is sure to give the alarm, and thus the purpose of the assailant is defeated.

COMMON JACANA (*P. jacana*) is of a rich maroon brown on the upper part, and the same colour on the under part, only more obscure in the tint. The head, neck, throat, and breast, are black with metallic reflections; the quills are yellowish green, with black borders; the bill yellow, and the frontal membrane reddish yellow. This membrane forms three lobes, which are not attached to the forehead, and it has two fleshy appendages at each side of the upper mandible. The spine on the angle of the wing is large, conical, and of a white colour; the legs are greenish grey: the length is about ten inches. The young have some white on the under part, are lighter in the colour, and of smaller size. This species is very generally distributed over the warm parts of America, and is common in Brazil, in Guiana, and in some of the West India Islands; it inhabits the borders of pools and rivulets almost invariably in pairs.

BRONZE JACANA (*P. aenea*). This is rather a doubtful species, and is probably the same with the Brazilian jacana of some authors; and also with one or two others, which are known only in museum specimens, generally supposed to have been obtained from Brazil.

SENEGAL JACANA (*P. cinnamomia*). Is a native of Central Africa. It is maroon brown on the upper part and deep brown on the under: the head is black, the lower part of the neck white, the breast russet, the bill yellow with a blueish-grey frontal membrane.

INDIAN JACANA (*P. Indica*). Is found in Bengal

and other humid parts of India. The upper part is brownish ash, and the lower and also the head and neck blueish black: the quills are blackish violet; there is a white streak over the eye; the bill is yellow with a blackish-blue frontal appendage; there is a red spot at the angle of the gape; the feet are brownish; and the length is about nine inches.

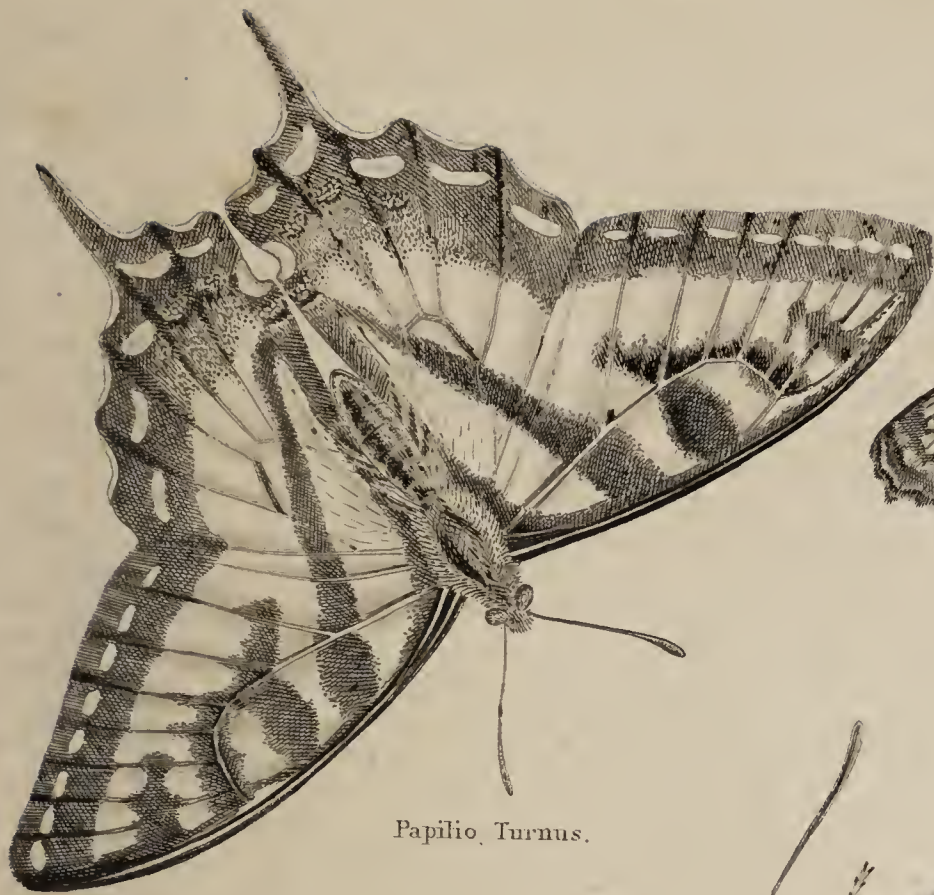
CRESTED JACANA (*P. cristata*). This species is about ten inches in length: it is bronze green on the upper part, and has the head, the neck, the lower part of the back, the breast, and the belly, dull green; the rump, the flanks, the vent-feathers, and tail-coverts reddish brown; the larger coverts and primary quills of the wings blackish green; the feet and toes green with brown claws, the bill yellow, and the frontal appendage smooth, and of a crimson red. This species is found in Ceylon and other parts of the east.

LONG-TAILED JACANA (*P. Sinensis*). How this species came to get the name of "Chinese" it is not easy to say; because it inhabits not China but the eastern Archipelago. The upper parts are reddish brown, and the under parts deep purple brown; the head, the throat, and fore part of the neck are white, pencilled with black; the hind part of the head is black, and the back of the neck very rich golden yellow; the coverts of the wings are white; the primary quills black, and the secondaries white with black borders: the colours of these parts do not, however, appear to be constant; the tail feathers are black, and the four middle ones are longer than the rest, and pendent over them in a very graceful curve: the bill is blueish, and the frontal appendages and the feet are green; the spine on the wing is horn colour, and of moderate size. The total length is from eighteen to twenty inches, of which, however, a considerable portion is taken up by the produced feathers of the tail.

Such is a short list of the chief species of these very peculiar birds; and it is not a little remarkable, that while so many birds of decided migratory habits are confined to one or other of the two continents, these stationary birds should be found in both, and in both tropical parts of the eastern one. We have no reason to suppose that they passed from the one continent to the other, although their manners in both appear to be very similar.

END OF VOL. II.

BUTTERFLIES.



Papilio Turnus.



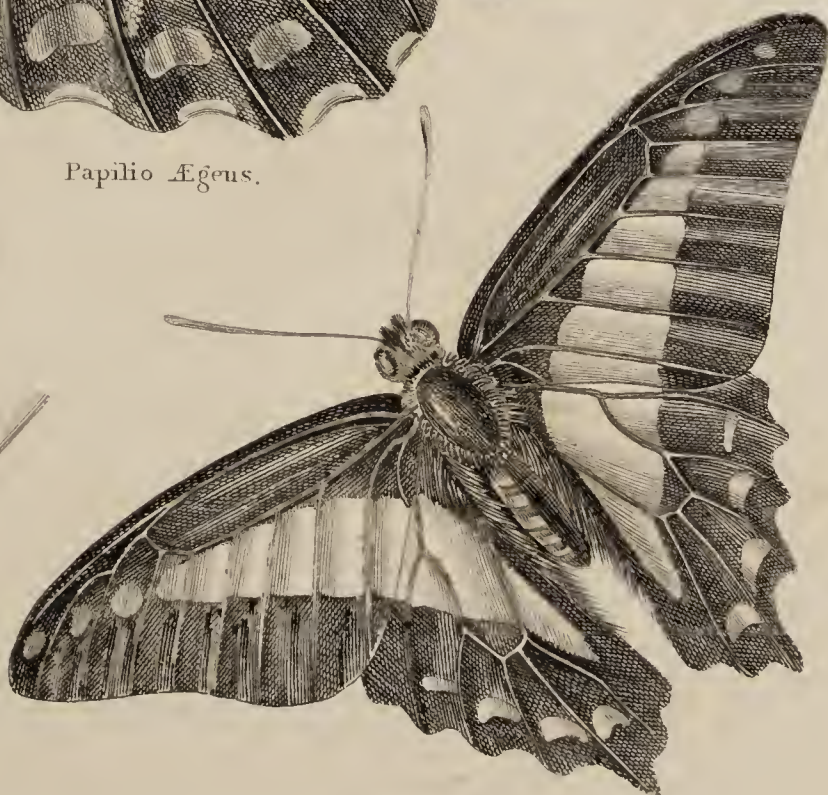
Cynthia Orythia var.



Papilio Ægeus.



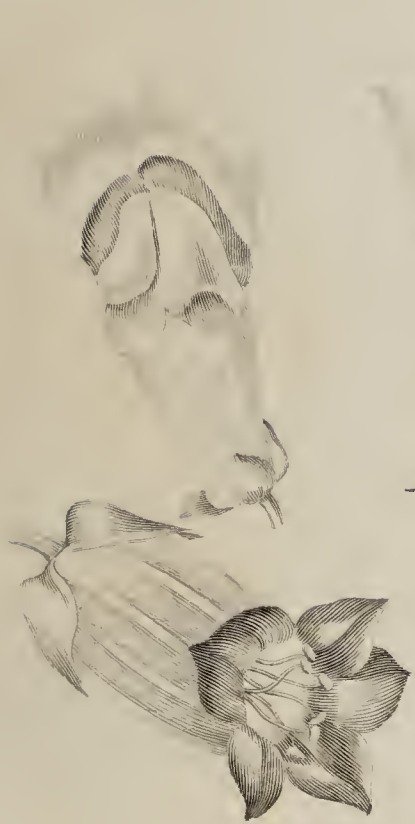
Thecla Sugriva.



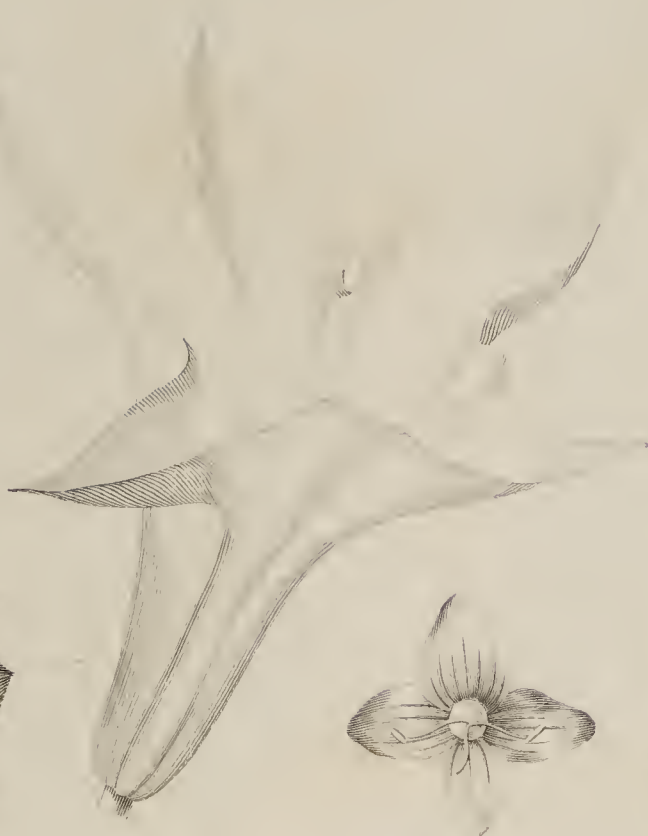
Papilio Sarpedon.

COROLLAS.

Personate



Infundibuliform



Ringent



Campanulate

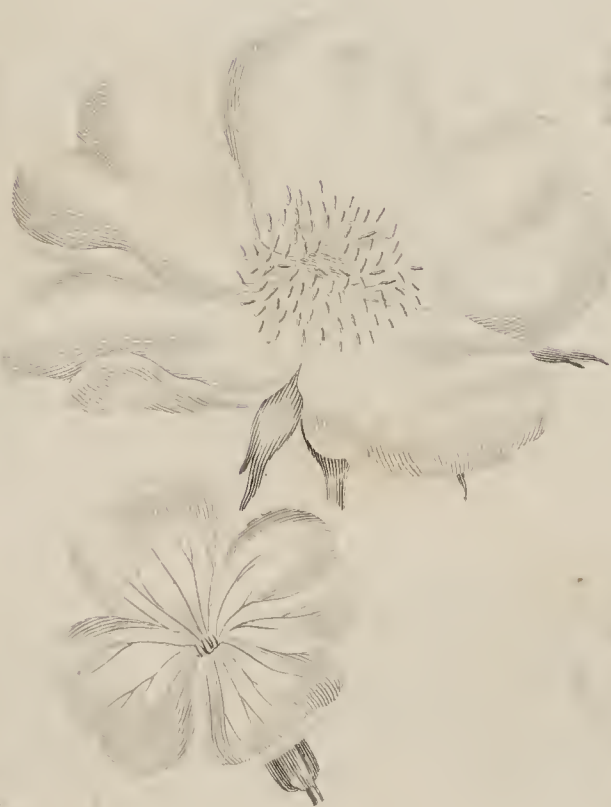
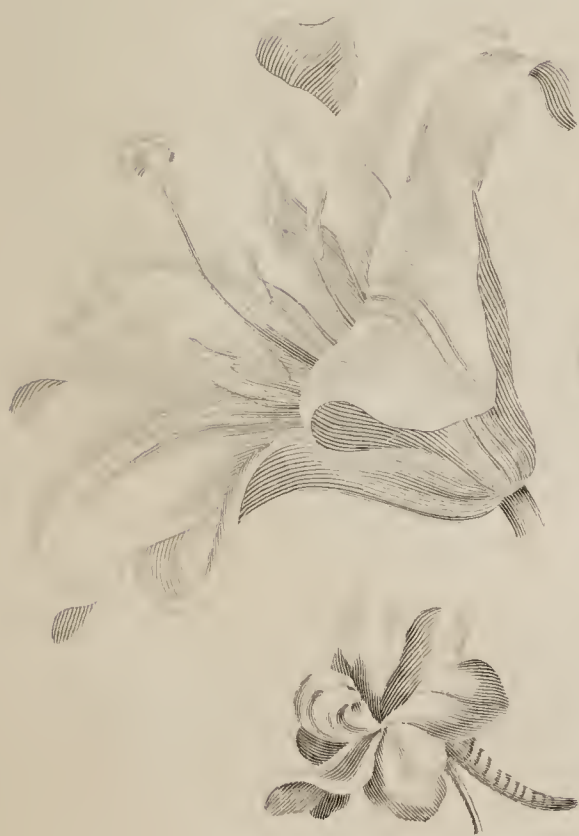
Rotate

Hypocrateriform

Liliaceous

Rosaceous

Caryophyllaceous

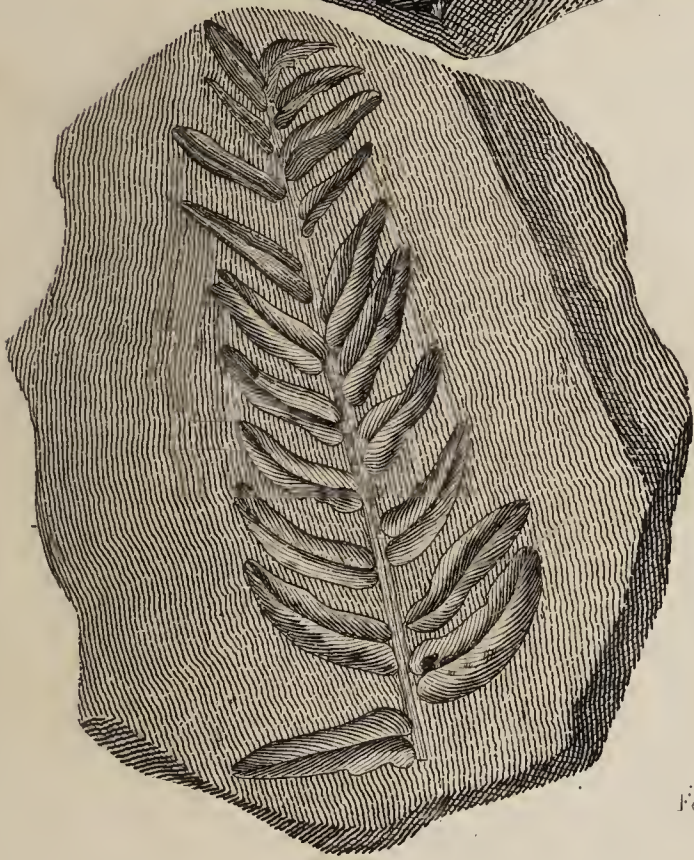
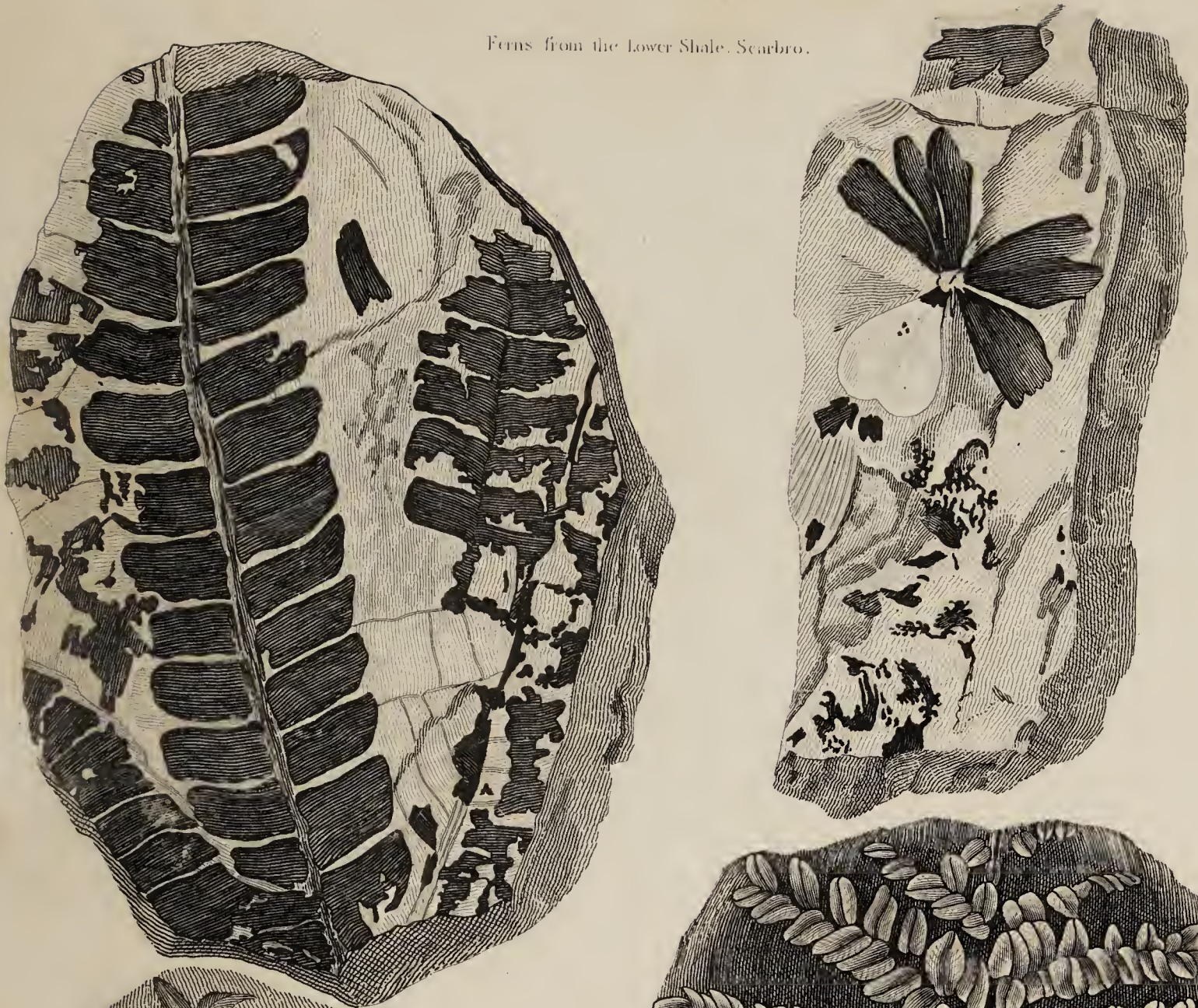


Noctiferous spurred Flower

Cruciform

Papilionaceous

Ferns from the Lower Shale, Scarbro.



Ferns from the Coal Formation.

*Belemaites elongatus.*

ICHNEUMON.



Indian Ichneumon.



Egyptian Ichneumon.

FALCONS.



Ash coloured Falcon.



North American Falcon.

Bengal Falcon.

Orange legged Falcon.



Four Horned and Common Goat.



Cashmere Goat.

Rocky Mountain Goat.



Harpy Eagle.



Sea Eagle.

HYÆNAS.



Spotted Hyæna.



Brook's Hyæna.

Striped Hyæna.

LEMUR.



Red Lemur.



Slow paced Lemur.

White-fronted Lemur.



Hippopotamus.

ELEPHANTS.

African Elephants. Male & Female.



Indian Elephant.

HUMMING BIRDS.



1. *Trochilus Urethrus*.

2. *T. albus Cristatus*.

3. *T. albus Cristatus*.

4. *Trochilus Auratus*.

DUCKS.



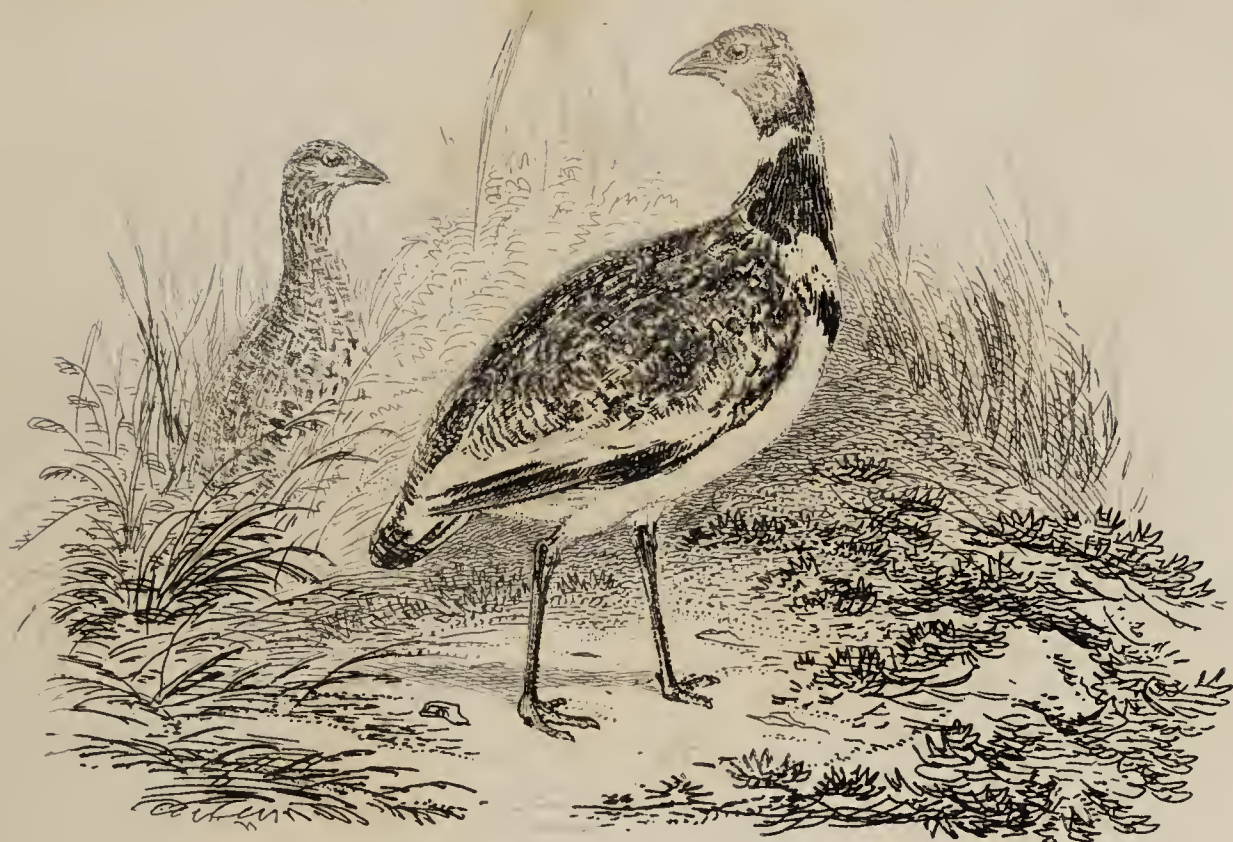
1. Gadwall Duck

2. Pint Duck

3. Long Tail Duck

4. Shoveler Duck

BUSTARDS.



Little Bustard, Male .



Great Bustard.



Calmuc Horse.



Shetland Pony.

Draught Horse.

